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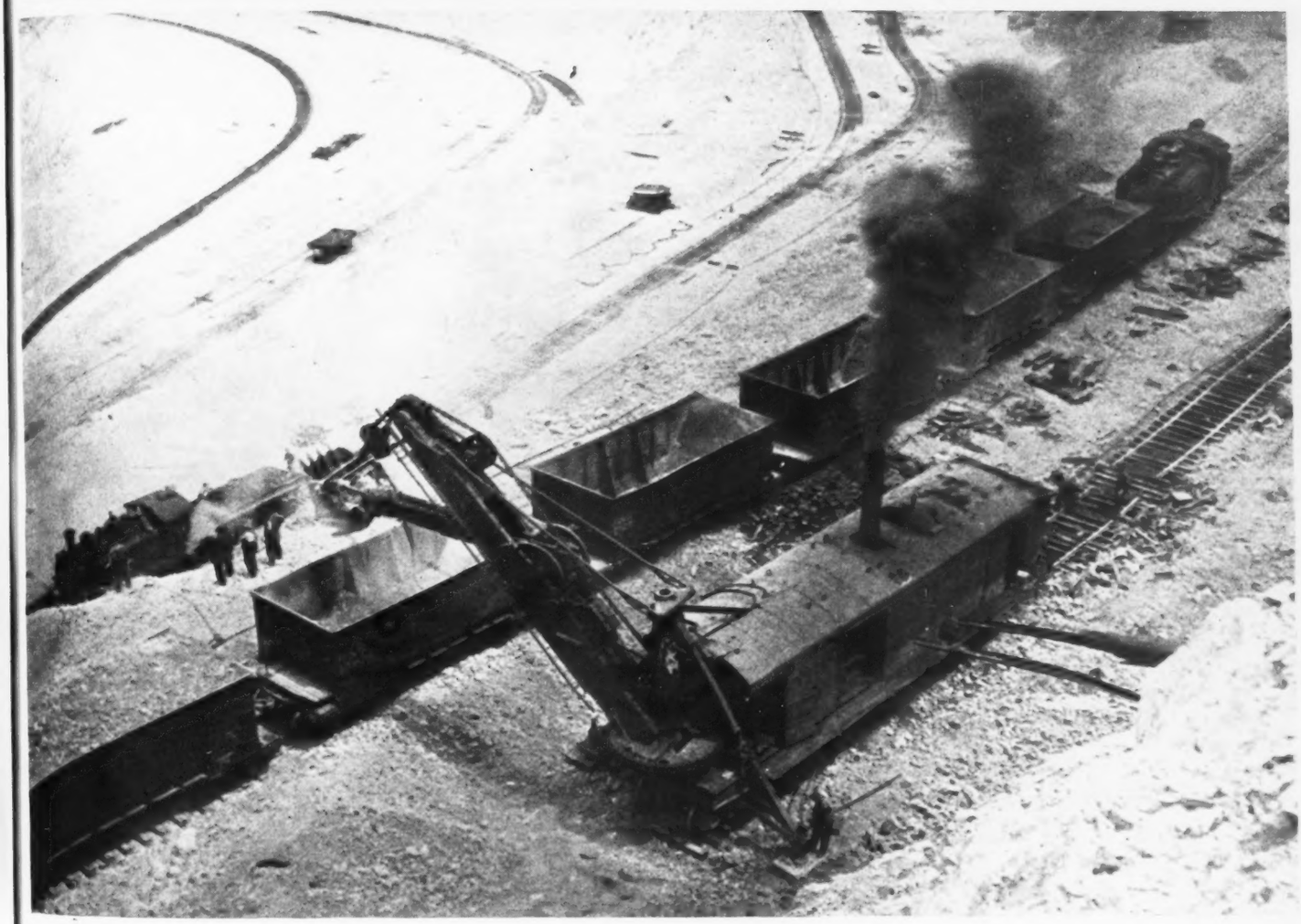

Twenty buckets are at work all day and six at night, loading rapid ore in Bingham Canyon for the mills of the Utah Copper Co. at Garfield

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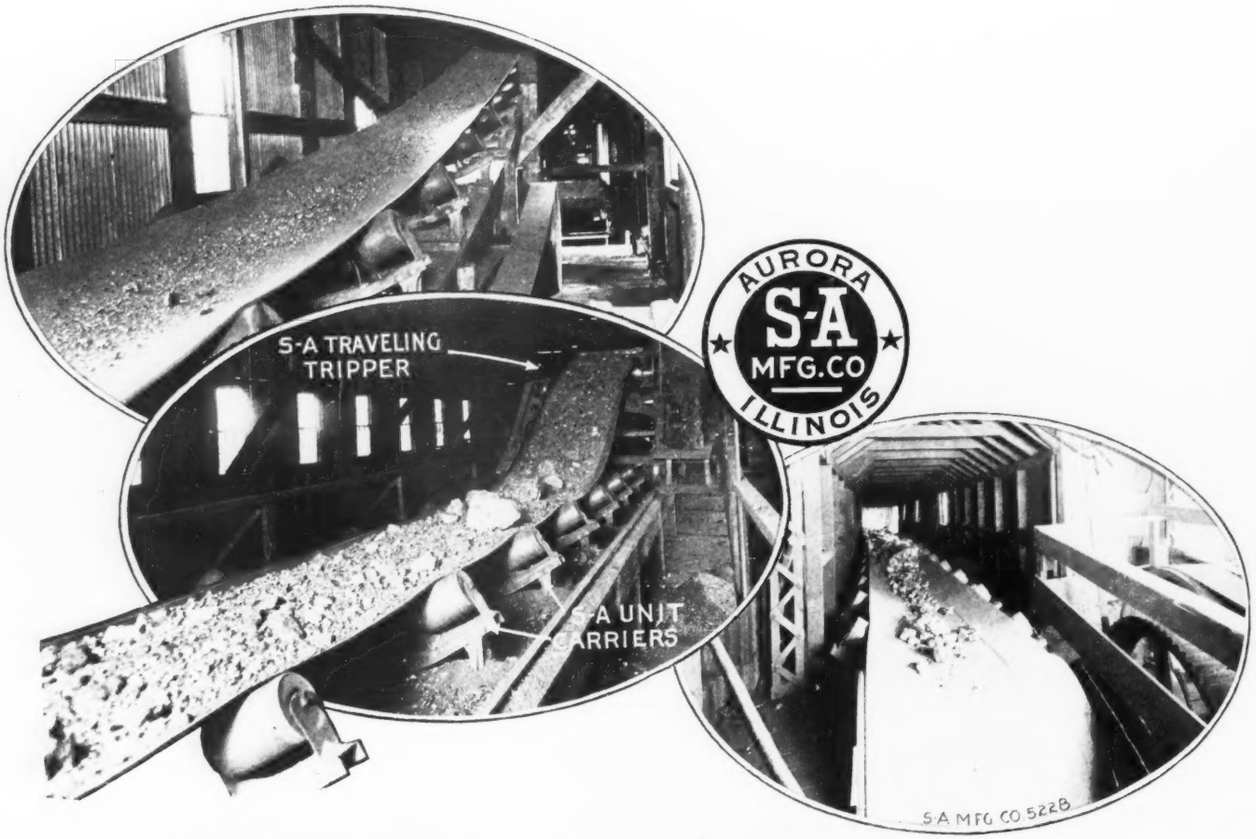

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ENGINEERING AND
MINING JOURNAL-PRESS

JOSIAH EDWARD SPURR, Editor

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The Institute in the South

THE SUMMER EXCURSION and meeting of the American Institute of Mining and Metallurgical Engineers offers a unique opportunity which is generally fully realized. Last summer's joyous trip through Ontario and Quebec was hardly more successful than that of this month through the Southern ore fields. The visits to mining districts are not the least of the pleasures and opportunities—the chance to inspect, above and below ground, well-known mining camps that one has heard about but not seen. It is true that in the ordinary rush of such visits, he who could take in correctly the details of a mine would be a wizard the like of which does not exist among us. But the permanent benefit from such a visit, even if hasty, is the ability henceforth to visualize the background of such camps—to establish a vivid setting on which one may place such details as he may learn, whether then or thereafter from time to time. It is an old witticism that there are three things a mining engineer should do: Travel, travel, travel. It is not true that study alone will compensate. Travel, study, travel, should perhaps be the happy triad of desirable activities.

On the Southern meeting the members had a chance, even if fleeting, to see coal in the Pocahontas field, zinc at Mascot, Tenn., copper at Ducktown, Tenn., marble near Knoxville, and iron and coal in the Birmingham district of Alabama. The live and bustling industrial activity near Birmingham was of itself a stimulating experience. The enthusiasm, the keen discussions, the vision of even larger events and opportunities, brought one back to other mining regions before they settled down to maturity and senescence. Birmingham is indeed self-sufficient, unique, with coal, iron, and flux all close together; and if all are not mined from the same mine, those Birmingham enthusiasts who visualize this event cannot be placed in the category of idle dreamers. It is a thing which may very well some day come to pass.

For those who are not too serious minded—and indeed this applies to all—there is the stimulation of good-fellowship and new personal contacts. Surely no more keen, good-natured, and courteous a crowd ever gets together than at a meeting of mining engineers. They take notes, they talk, they lunch, they dine, they speechify after a fashion. As orators they are excellent miners: nevertheless, by the continued use of gentle and kindly phrases like "distinguished guests" and "Southern hospitality" they modestly survive. There is no better custom of the Institute than the summer meeting; there is no feature which is better done.

The Outstanding Event

THE most important event in the United States in October, if popular interest is any criterion, was the "world's series." About 100,000,000 people were much more anxious to have Walter Johnson and his cohorts win the baseball championship than they would be to have the United States corner the world's supply of oil or to have their favorite elected President. In fact, the President himself saw three of the games, and when 39,999 people out of the crowd of 40,000 went wild as the final winning run was scored, it is said by Heywood Broun that even the President's throat was seen to twitch with emotion.

The games have had an important effect on the mining industry, which is our excuse for mentioning the matter editorially. We estimate that 14,368 fewer tons of ore has been mined during October owing to the time required to discuss the work of the players and the chances of the teams, and goodness knows how much more will be lost during the winter.

Fair Dealing With Shareholders

REFERRING TO THE BINGO PROPERTY, in the Herb Lake district in Manitoba, our correspondent at Toronto recently made a plea for a thorough examination and report by a competent and reputable engineer. "Unofficial" reports have been circulated to the effect that ore reserves to the value of $3,300,000 are assured and that the company plans to erect a large cyanide plant "at an early date." It seems that those in control of the property have rigidly excluded outside engineers from the mines. Although this is, of course, their privilege, it is contrary to the usual custom in Canadian mining districts. Grab samples taken from the dumps by various visitors do not tend to support the claims made in the reports given to the public, and this fact, together with the policy of secrecy, has aroused suspicion in Canadian mining circles as to the real merit of the property.

Only recently an unsavory situation was exposed in connection with the Porcupine-Davidson Gold Mines, Ltd., which negotiated the purchase of the Davidson Consolidated property in 1921. Since then about $600,000 has been spent in sinking and other development, and a $500,000 payment became due on Sept. 15, 1924. An examination made a few months ago by Messrs. R. H. P. Bullen and H. A. Kee revealed the fact that, in the estimation of these engineers, the "orebodies" were not sufficiently large or rich for profitable exploitation. A prospectus published in 1921 quoted R. C. Fielding as estimating 350,000 tons of $11 ore with working costs of $4 per ton. The prospectus made Mr. Fielding and Messrs. Loring and Bent compare the property favorably with the Hollinger and McIntyre and otherwise rate it as potentially a large and profitable producer. In informing the shareholders of the conclusions in the Bullen-Kee report, the directors make this remarkable statement: "We are now informed that certain assay plans of the upper levels made prior to the formation of the company accord with the sampling result obtained by Mr. Bullen and Mr. Kee." The implication is a serious one. So far as has been shown yet, no report was ever made in behalf of the Porcupine-Davidson Gold Mines, Ltd., the directors of which seem to have accepted the Fielding

and Loring-Bent reports without any attempt at corroboration.

Still another peculiar situation recently has come to light. Last June the officials of the Esperanza, Ltd., operating once highly profitable mines at El Oro, Mexico, reported to the shareholders, "We now feel justified in giving you positive assurance of future profitable operations." This followed the starting of the newly remodeled 1,000-ton per day plant, which was designed to treat 1,000,000 tons of "proved" low-grade ore at a profit of 50c. per ton. These figures were estimated by Charles Hoyle, the manager, and were corroborated by Hugh Rose, of the Mexican Corporation. In fairness to Mr. Hoyle it may be said that much of the material it was proposed to mill was to come from old stope fillings, the value of which is hard to estimate. The "positive assurance" may be attributed to the directors rather than to the engineers. About the middle of last August, C. A. Lantz, consulting engineer, announced that the program to mill the low-grade ores was a failure and that as a "last resort" it was planned to mine selectively the richest ore and mill on the basis of 10,000 tons per month. Obviously, it is difficult to reconcile the divergent official statements made only two months apart. Shareholders in London first were astonished and then indignant.

The best engineers sometimes make mistakes in judgment and in their calculations; we are not prepared to pass judgment on the engineers or the directors either of the Esperanza, the Porcupine-Davidson, or the Bingo companies. We insist, however, that shareholders are entitled to know all the facts concerning the enterprise in which their money is invested. If new conditions develop, if new information of importance is brought to light, it is their right to know it at once. Mining depends on public support, and the only way to encourage public participation is to give the shareholder a square deal.

Smelting Copper Concentrate in a Converter

THOSE on the A.I.M.E.'s southern trip who were interested in copper smelting had an opportunity to see something novel at Copperhill, in the direct smelting of copper concentrate in a converter. The horizontal Peirce-Smith type of converter is used, and the dried concentrate is blown in with the Garr gun as was described in these columns last January. It has been said that the converter has been blown for as much as eight hours with no additions of liquid matte—just concentrate and flux. This procedure is not usual, however, for there is always blast-furnace matte to be handled.

This practice suggests the possibility of smelting concentrate direct in a converter, eliminating the reverberatory furnace entirely. So far as we know, this has never received a large-scale test. Attempts have been made to smelt coarse ore in a converter-like vessel, as in the Knudsen furnace, used in Norway, and with rather satisfactory results. It would seem that fine ore would be even more suitable for such treatment, if added gradually. Hot calcined concentrate might be blown into a converter instead of cold material, but the extra heat gained in this way would be offset by a smaller amount of sulphur available for oxidation and heat production. A small percentage of gas or atomized oil might be introduced with the air blast if it were found necessary to maintain the heat. Smelters can easily try this experiment by by-passing a part of their reverberatory feed direct to the converters, or they can remove a little of the material from the first or second hearths of the roasters for this purpose.

Continental European Countries Want Silver Money

PROGRAMS FOR SUBSIDIARY COINAGE recently formulated by European countries call for about 61,250,000 oz. of new silver, according to figures published by the *Financial Times*, of London. The distribution is as follows: Danzig, 1,500,000; Latvia, 2,500,000; Austria, 7,250,000, and Russia and Germany, 25,000,000 oz. each. Whether these plans are realized, and how soon, depends on the ability of the respective nations to finance the purchases. It is important, however, that the policy of using silver seems fairly settled in these countries at least. Stabilization of currency is the first step to a return of normal business; and the first step toward stabilization is to inspire the great masses of the people with confidence in the medium of exchange, as was pointed out recently by F. H. Brownell, of the American Smelting & Refining Co. in an address at Salt Lake City.

Irrespective of what statesmen and bankers and economists theorize concerning the most desirable form of currency, the "people" of a country that have been through the throes of paper-currency collapse, and that have seen governments wiped out of existence, want money that has intrinsic, tangible value. That means principally gold and silver; and in the countries of Continental Europe it is impracticable to coin gold in units small enough to serve the purpose. This demand for metal money may be sentimental foolishness on the part of common folks; nevertheless, the demand exists and the leaders seem to recognize it.

Even if only a part of the present plans are carried out in the next year, the silver-mining industry as a whole will profit. The purchases may be made by agents buying small lots in the open market. On the other hand, it is possible that a situation may arise in which co-operation on the part of individual producers will facilitate these purchases. In this connection the American Silver Producers' Association may find an ideal opportunity to display its worth. For example, one of these countries may desire to contract for the monthly delivery of a specified amount of silver at a fixed price. It might argue that to contract to purchase a large quantity of silver to be delivered in the future at the market price would in itself tend to bull the market. It might fear that the market would be manipulated to the disadvantage of the purchaser. It might with reason insist on a contract at a fixed price. In the sale of 3,000,000 oz. to Poland, the American Smelting & Refining Co., the United States Smelting, Refining & Mining Co., the Anaconda Copper Mining Co., and the American Metal Co. sustained a distinct loss because the market price for the metal passed the specified contract figure. They did this willingly because they were anxious to encourage business of this kind with these governments.

But in the event of the negotiating of large contracts for future delivery, it is possible that the smelting and refining companies would not care to risk the necessity of selling at a fixed price metal that they would have to pay for at a higher rate in ores pur-

chased from mining companies a month or twelve months after the contract was made. Some kind of a co-operative agreement in which each producing company would pro-rate the business according to the ratio of its individual output to the whole output would be in order.

As original producers from the mines, the big companies would of course participate in proportion to their output. Doubtless Mexican production as represented by the A. S. & R. and U. S. S. R. & M. companies, at least, would be included; and conceivably Canadian companies would co-operate. The arrangement of details for such a plan and the execution of it would be an appropriate function for the American Silver Producers' Association.

Who Did This?

A "MEMORANDUM FOR THE PRESS" from the Department of the Interior, heralding a "renewal of activity in the mining industry throughout the whole Pacific Coast district after the stagnation of recent years," is based on "special reports from representatives of the Bureau of Mines." Among other things it is stated that "all the large copper companies in Arizona are continuing operations on a reduced scale." What about United Verde, which recently broke its highest war-time record; and Magma, New Cornelia, and United Verde Extension? The Coeur d'Alene district, says the report, is "very active in producing gold, lead, and zinc." We wonder who the Bureau of Mines representative was who placed gold first and overlooked silver entirely. The Bureau had better edit the stuff that the Department sends out citing the Bureau as an authority.

The Best Lining for Mills a Local Problem

LAST WEEK we published an article written by an Englishman who has made a study of ball- and tube-mill liners. We believe this was interesting to a large number of our readers, not only because Mr. Miller went into considerable detail regarding the various designs of liners, but because of his detached viewpoint, being in another country, and because of his knowledge of the types of linings made by English and German manufacturers.

The subject of economical linings for ball mills has been given a large amount of study by American manufacturers, and perhaps more particularly by the large users of grinding equipment, since it is they who are more directly interested. The manufacturer must study the design of his mill, its bearings and driving mechanism, but the user is responsible for proper pulp density, speed of rotation, ball load, composition of balls and liners, and similar details coming under the head of operation. Millmen have found it easier to experiment with their ball mills than with most other units of their plants, and the economies that may be effected can be definitely calculated.

Both the shape of liners and the material of which they are made have received a great deal of attention. The proper shape can well be studied by an inspection of the worn plates on the scrap heap. If one part wears much thinner than another, the original design for that particular work was faulty; either the place where the wear is most noticeable should have beeen thicker, or other parts of the liner originally should have been cast thinner. There is a limit to the thickness, one of the factors being that if a plate is too thick it is difficult to harden it properly throughout its cross-section. There is also an obvious limit to the thinness of the parts which do not get much wear, for the plate must have the proper shape and be rigid. Separate pillow blocks, which may be used with successive sets of liners, may provide the necessary thickness where there is little wear. Those in charge of the Inspiration mill, in Arizona, have gone far in the development of such pillow blocks.

Manganese steel has come to be a favorite material for liners, owing to its durability. Its cost is its biggest disadvantage, and some companies which maintain local foundries and which have convenient means for relining their mills frequently, find it more economical to use common hard white iron or semi-steel castings. The Homestake company, for instance, has definitely decided to give up the use of expensive alloy steels for this purpose, and to rely on the homemade product.

The superintendent of almost any mill can well afford to experiment a little both as to the form and composition of his liners. He must not judge too much by the practice adopted by some other progressive plant, for local conditions, both technical and economic, have a great deal to do with the solution of the problem.

Real Progress in World Affairs

MORE SIGNIFICANT than the financial and economic are the diplomatic and psychological aspects of the enthusiastic response of investors, both in the United States and in Great Britain, to the flotation of the $200,000,000 German bond issue. Where billions are involved, $200,000,000 is not much. But the public attitude that is revealed by the willingness—even anxiety—to subscribe to the bonds is reassuring. It indicates a recognition of the fact, which clear-sighted economists have seen all along, that without internal prosperity, or at least industrial activity, nothing in the way of adequate reparations could be paid by Germany.

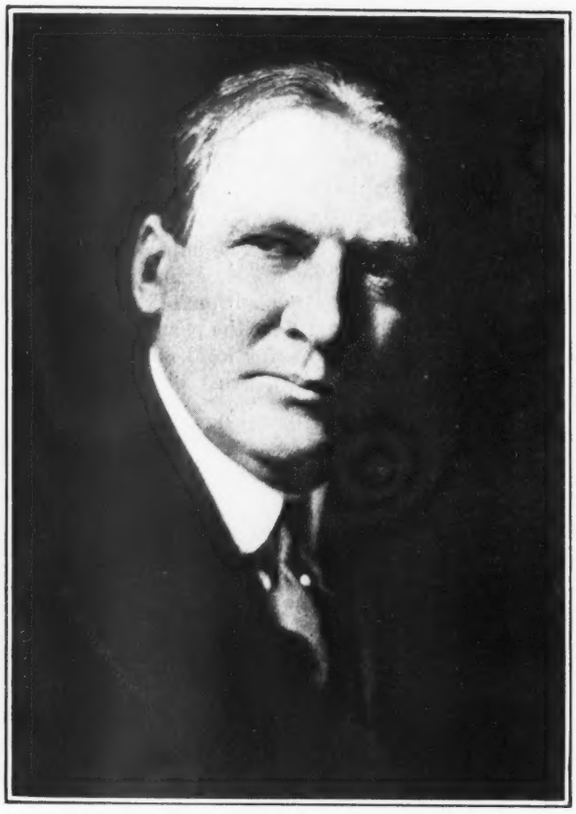
Heretofore, whenever plans have been proposed for the rehabilitation of Germany some British or American interests have immediately become apprehensive that the revival of a particular industry in Germany would seriously injure a competing industry of their own; and they have been loath to lend assistance. That apprehension in many instances still persists; but apparently it is being submerged in the realization that the general public in Britain and America is tired of the unsettlement of affairs and is ready to make some concession to end it. Public sentiment will compel any recalcitrant interests to fall in line. In the long run they will probably share the benefit, for no real progress can be made toward world recovery until Germany is revived.

It is true that the British coal and steel industries and some American chemical industries may suffer from the resulting competition, but ultimately they will gain, as a consequence of improved economic health throughout the world. So far as the non-ferrous metal industries are concerned, they have little to lose and much to gain. Especially should silver and copper producers find reason for satisfaction.

Mining Engineers of Note

William Lincoln Honnold

CATHOLICITY OF INTEREST and breadth of experience are characteristics of the successful mining engineer, of which W. L. Honnold is a conspicuous example. After special courses at Knox College and the University of Michigan, he entered the Michigan College of Mines at Houghton, his training being broadened by work with the Geological Survey of Michigan and by prospecting. He discontinued his studies soon before graduation time, to accept a position with the Mahoning Ore Co., in Minnesota, where for three years he was associated with W. C. Agnew in the development, equipment, and early operation of the company's iron mine. He received his degree from the Michigan College of Mines in 1895. Resigning as assistant manager of the Mahoning company in 1896, he went to California to become superintendent of the California Exploration Co. and subsequently manager of the Thorpe Gold Mining Co. Between 1899 and 1902 he was consulting engineer in America to the Consolidated Mines Selection Co., of London, going to South Africa in 1902 as consulting engineer for that company and its subsidiaries. He became managing director in 1912, a position held until 1915, when he engaged in war-relief work. Mr. Honnold's achievements in South Africa deflect attention to the Far East Rand, where his group, by control of coal mines, had gold-mining rights over large areas of deeply underlying gold-bearing formation. The first mine, Brakpan, brought to production in 1912, has paid good dividends regularly. In a paper read before the Institute in 1915, Mr. Honnold disclosed the pluck of his principals: "When first considered, its remoteness from known conditions rendered it a speculative venture; and even when $188,000 had been expended on boreholes and other preliminaries, the outcome was problematical. Thereafter, a further expenditure of $5,772,000 . . . was needed before the commencement of milling. Perhaps no more notable instance of the confidence which the Rand has inspired is available; and . . . it is doubtful if there has been an issue of more vital importance to the industry." Brakpan, therefore, was in the nature of a pilot mine, the successful development of which led to the exploitation of Springs and West Springs, of particular interest to American metallurgists because of the adoption of all-sliming. The area in this district now under control of Mr. Honnold's company amounts to about twenty-five square miles. Other groups have also been active, with the result that the district's output for 1923 amounted to about two-thirds of the Rand's total. During his stay in South Africa Mr. Honnold took an active and honorable part in the direction of the gold-mining industry as a whole. He was vice-president of the Transvaal Chamber of Mines and of the South African Institute of Mining Engineers. Mr. Honnold was in London between 1915 and 1917, and in New York thereafter until 1919, as director of the Commission for Relief in Belgium. In recognition of these services King Albert conferred on him the following decorations: Comandeur de l'Ordre de la Couronne and the Medaille Commemorative du Comité National. He was also a recipient of the Medaille Reconnaissance Française. After the armistice he went to Europe as representative of the Guaranty Trust Co., to arrange financial assistance to Belgian bankers. Subsequently, Mr. Honnold went to South Africa, having been instrumental previously, in co-operation with Sir Ernest Oppenheimer, in forming the Anglo-American Corporation of South Africa, which in addition to its gold-mine holdings, already mentioned, controls the Consolidated Diamond Mines of South-west Africa, is interested in the diamond mines of Angola and is a member of the London Diamond Syndicate. Honnold in addition to being a permanent director of the Anglo-American Corporation, is a director of the Rand Selection Corporation, Springs Mines, West Springs, and the Commission for Relief in Belgium Educational Foundation. He is a member of the Institute and of the Mining & Metallurgical Society of America, of the Geological and the Chemical, Metallurgical & Mining societies of South Africa, and of the Institution of Mining & Metallurgy, of London.



WILLIAM LINCOLN HONNOLD

Breaking Ore at Utah Copper

The Procedure Followed in Drilling, Blasting, and Sampling—Shovel and Car Equipment Used

By George J. Young
Associate Editor

MINING OPERATIONS at the Utah Copper mine, in Bingham Canyon, Utah, are divided into stripping the overburden and ore mining. Both involve rock excavation on a large scale from an open pit developed as a series of benches of varying height. The projected vertical height of the ore face is 1,100 ft. The thickness of ore is 556 ft. and the average thickness of overburden 115 ft. From 1910 to 1923, inclusive, the total ore mined was 100,365,176 tons and the total overburden removed 57,018,043 cu.yd. The maximum of ore mined in one year was in 1917, when

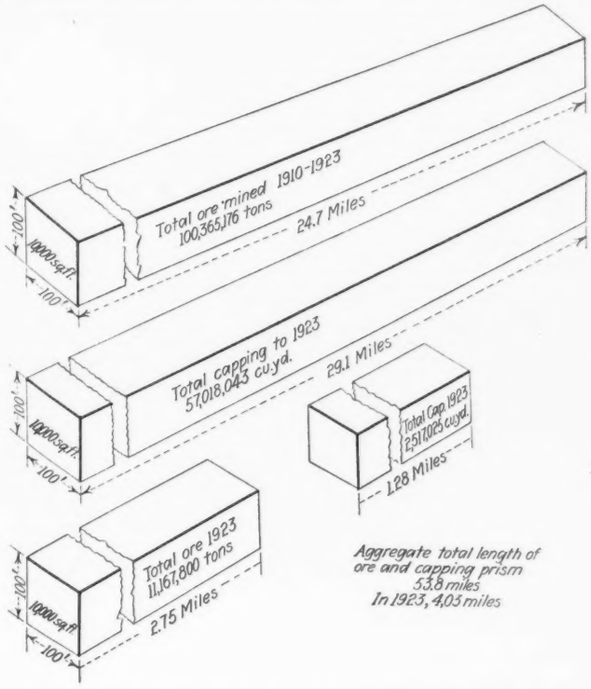


Fig. 1—Visualization of ore and cap-rock tonnages

12,542,000 tons was handled. In 1923, the output was 11,167,800 tons.

To visualize in some measure the foregoing figures, I have computed several prisms, each with a base of 100 ft. square or an area of 10,000 sq.ft. The aggregate ore tonnage from 1910 to 1923, inclusive, forms a prism of this cross-section, 24.7 miles in length. The overburden prism is 29.1 miles long. The two laid end to end cover 53.8 miles. During 1923, 11,167,800 tons of ore was mined, or an average of 31,908 tons per day on the basis of 350 days per year. On the same basis, an ore tonnage equivalent to a prism 100 ft. square and 41.4 ft. in length was broken, loaded, and transported each day. The overburden prism would be 19.4 ft. long and of the same cross-section. Each day therefore requires the breaking of ore and rock equivalent to 608,000 cu.ft., or a prism 60.8 ft. long and 100 ft. square, assuming 350 days to the year.

The total working crew, including stripping operations, approximates 1,500 men. The average per man, including overburden, approximates 31.2 tons per shift. This includes mining and transportation from bench to waste pile and from bench to train yard.

The overburden is quartzite and varies from hard rock to soft clayey material. It is extensively weakened by fracture planes and fissures. The ore, decomposed monzonite, is likewise extensively weakened by intersecting fracture planes. It ranges from compact, medium hard to relatively soft material. The ore breaks small, with only a small proportion of oversize. Block-holing is only an incidental problem. The overburden varies between wide limits, and some portions break large, although much of it gives no trouble in this respect. The angle of slope between benches ranges from 45 to 60 deg. The angle of repose of broken ore and overburden is 34 deg.

Drilling and Blasting Practice

Blasting practice has been developed over a period of years and has been reduced to the most direct procedure. Simplicity is an important characteristic. Ingersoll-Rand piston drills (F24), 3.5-in. piston, have been used for a number of years and apparently satisfactorily meet the conditions peculiar to this operation. They are mounted on tripods which are used without leg weights. Solid steel is used. The starting bit is three inches in diameter and the bits in a set of eleven steels vary by $\frac{1}{8}$ in. in successive diameters, the finishing bit being $1\frac{1}{2}$ in. in diameter. Cross bits are used. Compressed-air mains form a complete circuit on both sides of the open pit. Pipe sizes range from six to eight inches. Two-inch branches are placed on each level paralleling a two-inch water line. Branch pipes extend to the drills. Compressed air is supplied by a direct motor-driven Ingersoll-Rand and two belt-driven Nordberg compressors.

Three kinds of holes are drilled—toe holes, bank holes, and vertical holes on the berm near the edge. The first two point down at a low angle. Toe holes are drilled from a position slightly above the bench level and are bottomed at about grade. They are spaced 10 to 15 ft. apart, depending upon the firmness of the ore. The depth of hole is 22 ft. The ground ravels to a certain extent, owing to the vibration of the drill and also to its fissured character. Two drills are operated to each shovel, one crew ahead of the shovel putting in bank holes and the other behind the shovel putting in toe holes. Vertical holes near the edge of the bank are put in as needed.

When drilling continuously for a shift, a drill crew will average a footage of 30 ft. The sequence of the holes is shown in Fig. 2. The toe hole is first blasted, which gives a position for drilling; the next hole above is blasted, and gives a drilling position for the third hole. The last or vertical hole is drilled from the bench. Two holes between the top and toe holes are generally required for breaking a bench from 75 to 90 ft. in vertical height.

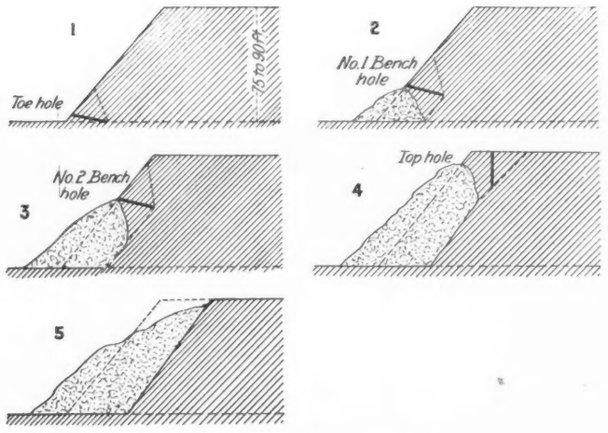


Fig. 2—Blasting a high

All drill holes are sprung. The toe holes are sprung in sequence in groups of fifteen. The first springing charge is five sticks (1¼x8 in.) of powder, followed by one bucket of water. A primer with a short fuse is ignited and sent to the bottom with a tamping stick and the charging pipe withdrawn. All powder is charged through a 1¼-in. pipe, 20 ft. long. A wooden tamping stick is used to slide the powder down to the bottom, a number of sticks being placed in the pipe and then sent to the bottom. After the first chambering shot the tamping stick is run in and withdrawn and tested for temperature. The charging pipe is placed in position and fifteen to twenty sticks are run in. Two buckets of water are then poured in through a funnel which is made from the packing paper of the explosive. A primer is inserted and the pipe is withdrawn. A third priming charge, thirty-five to forty sticks, follows the same procedure, with the exception that four buckets of water are used. The fourth or last priming charge consists of seventy-five sticks, or more, of powder followed by six buckets of water. This completes chambering and the hole is ready for the final charge, which consists of five or six boxes of powder. The water serves the purpose of stemming.

Extra L.F., 40 per cent Hercules powder is used for wet holes and Red H, 60 per cent for dry holes. Both are No. 4 ammonium nitrate powders. A wet hole is indicated by the fact that the tamping stick is wet when removed. No. 6 caps are used. A 2½-ft. fuse is used for priming shots; for final blasting a fuse length of slightly over 6 ft. is used. Eight are cut from a 50-ft. length of fuse. All fuse is cut by one man. Caps are crimped and the prepared fuses made up in bundles with the case and coil number attached to a tag on each bundle. Fuses are handled in sacks and are temporarily stored in a sheet-iron box 3 ft. long by 18 in. wide, one of which is placed on each level in a protected position at a distance from the magazine. A sheet-steel magazine on each bench for powder storage is protected on the top and sides by old railroad ties.

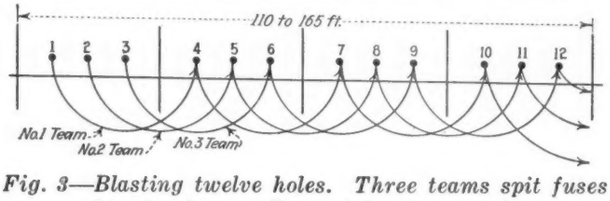


Fig. 3—Blasting twelve holes. Three teams spit fuses and load primers. Route taken by each team shown by lines

A single primer is used for springing shots. The cap is placed in the side and the short fuse length laced through the cartridge and sometimes looped around the top and held with tape. For final or main blasts two primers are used. These are placed in the cartridge and laced through and taped. Springing holes is done systematically, the blasting team of two men working on a hole and when finished going to the next hole. From three to five men to a shovel attend to blasting operations. Main blasts are exploded in groups of six to ten holes and sometimes twelve to sixteen. The procedure with twelve holes is as follows: the holes are grouped in threes and three teams of two men each handle the primers. The three teams take the three holes in a group. Fuses are spit and the primer cartridge sent down into the hole. Pipes are removed and each team proceeds to the corresponding hole in the next group, and so on to the last group, as shown in Fig. 3.

The twelve holes are blasted in sequence in groups of three. The time interval between each blast is short. No. 1 hole cushions No. 2 blast, and so on down the line. Long experience has resulted in the work being done rapidly in the necessarily short time. The time for a six-foot fuse is six minutes or more, and the fuses are usually spit in half that time.

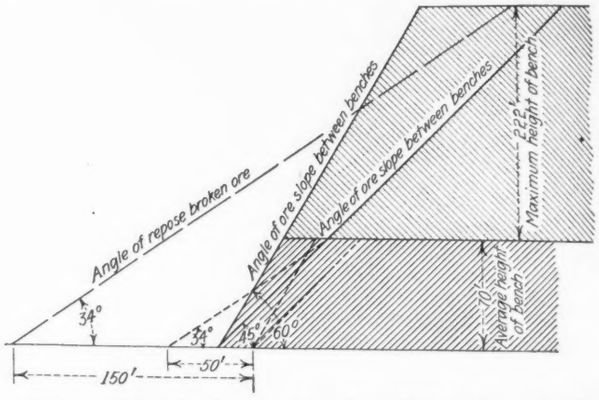
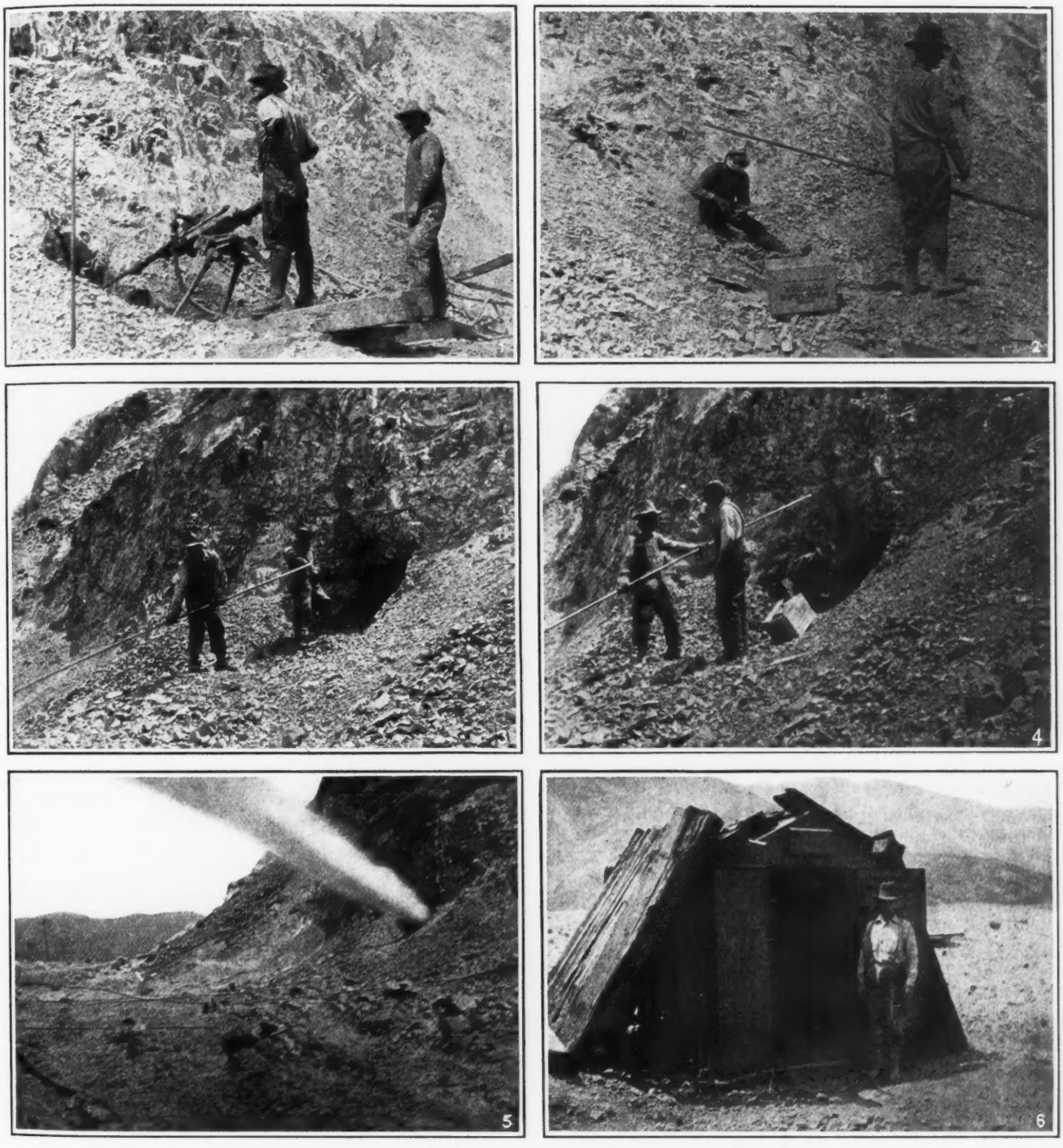


Fig. 4—Sketch showing bench angles and angle of repose of broken ore

The number of men employed on drilling and blasting operations varies with output, but when I visited the pit, the average number was 140. All of these men are under the charge of the blasting foreman, James Steele, who has been at this work for twenty-one years, and an assistant foreman. The explosives ratio is one pound to six tons of ore. In April, 1924, the average on ore and overburden was 226 lb. per 1,000 cu.ft., or approximately 0.15 lb. per ton. Caps and fuse cost $0.0007 per cubic yard. Including fixed general and maintenance charges, the mining costs in 1923 were approximately $0.35. This includes loading and transfer to train yards and 12.5c. for stripping. The actual direct cost of mining was 22.38c. per ton, which includes 3.2c. for fixed and general charges.

The height of benches varies from 65 ft. to a maximum of 222 ft., and averages 70 ft. The benches are convex toward the hill. Each joins with the switchback system, which is on a maximum 4 per cent grade and connects with the train yards. There are seventeen benches, and one shovel is operated upon a bench. Only one shovel cut is required on the low benches, but on the high bench three cuts are necessary. In Fig. 4, the limiting angles of the faces of the bench and re-



Successive steps in blasting holes at Utah Copper Mine

1. Drilling toe holes. 2. Loading a charge for chambering. 3. Preparing the primer. 4. Ready to insert primer. 5. The chambering shot sends a stream of fine material a considerable distance. 6. Powder magazines are made of light sheet metal and are protected from flying rock by railroad ties.

pose angle of the broken ore are shown in approximate relationship for an average as well as for the highest bench. The general angle of slope of ore face is 35 deg.

Shovels are advanced from the south to the north following the completion of blasting operations. Drilling of toe holes is done in the wake of the shovel. These are chambered and blasted in groups. The drilling of the bench holes and completion of the blasting is in advance of the shovel a sufficient distance to avoid interference. A new cut is ready for the shovel to begin upon as soon as it has finished. The sequence of operations, which are the same in overburden and ore, is shown in Fig. 5.

Two zones of operations are established, one from the top down to and including L level and the other from L level down. A general foreman is in charge over each zone. He is responsible for steam-shovel operations and transportation. A powder foreman is assigned to each zone. A general track foreman with two assistants has charge of all tracks and is responsible for their maintenance in pits and at dumps. A general superintendent, J. D. Shilling, is in charge of all operations.

A field and office force of engineers is maintained whose duties are to plan and lay out construction work and trackage and to prepare operating maps. The position of the benches is determined at intervals. Estimates of quantities, sampling, and the compilation

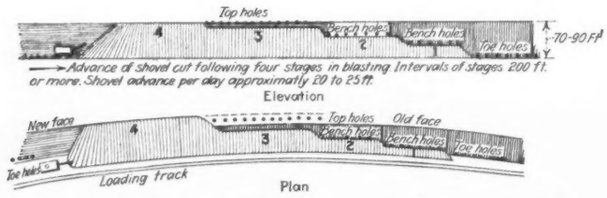


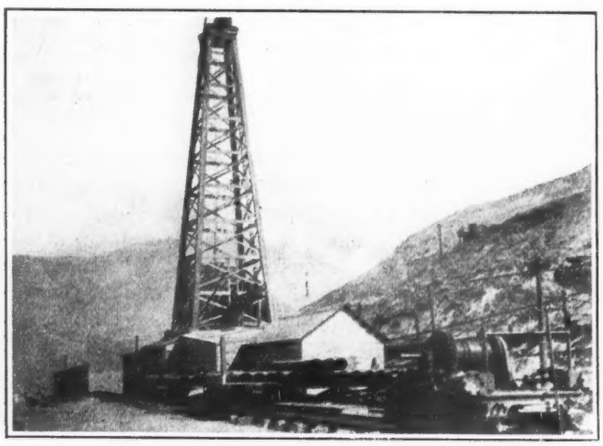
Fig. 5—Sequence of blasting operations on benches

of statistics are additional duties. G. C. Earl is in charge of the engineering department.

The maintenance of a uniform grade of ore is one of the important operating problems. Data of ore grades in different parts of the orebody are available from drill holes, underground workings, and miscellaneous sources. These are plotted on tracings, and blueprints of them are used by the engineers to approximate the grade of ore at any point on a given cut. Samples are taken after the shovel on the new bank before it is blasted. These are groove or chip samples at 10-ft. intervals. In addition, samples are taken at the toe of the ore pile daily, and these determine the disposition of the ore.

Assays are made on samples to determine the proportions of copper in oxidized as well as that in sulphide form. These results are also taken into consideration in holding up the grade of the shipments. During 1923, the average ore grade was 1.12 per cent copper. The problem of the engineer who may have ten or fifteen steam shovels in ore at certain points on any one day is to secure the bulk of his day's output from shovels operating on ore of shipping grade and restrict the tonnage of shovels on lean ore to such a quantity as can be balanced by the output of shovels in ore of richer grade. The difficulty increases as the number of shovels operating in shipping grade decreases and the number on lean ore increases. With all the shovels operating on ore below shipping grade, the mill feed naturally suffers.

An interesting feature of the sampling work is the drilling of additional sample holes to depths exceeding 1,800 ft. Two well-drilling rigs equipped with wooden derricks are in use. Holes are started at a diameter of 26 in. and cased with stovepipe casing. The cuttings from each five feet of hole are reduced in a small sampling mill to a 25-lb. sample. The bailer is discharged into a chute, which in turn discharges upon a ¼-in. mesh screen, the oversize going to a sample grinder (coffee-mill type). Undersize and oversize are laundered to a thickener (Callow cone), the discharge of which passes over a sample cutter. The sample is dried and sacked.



Use of well drill equipment for ore exploration. Note size of casing

In 1921, five holes were drilled, aggregating 2,113 ft.; in 1922 four holes were completed, aggregating 5,018 ft., and in 1923 two holes were completed, aggregating 1,912 ft. At the time of my visit one deep hole was being drilled and in addition a crosscut was being driven from the Ohio mine for sampling purposes.

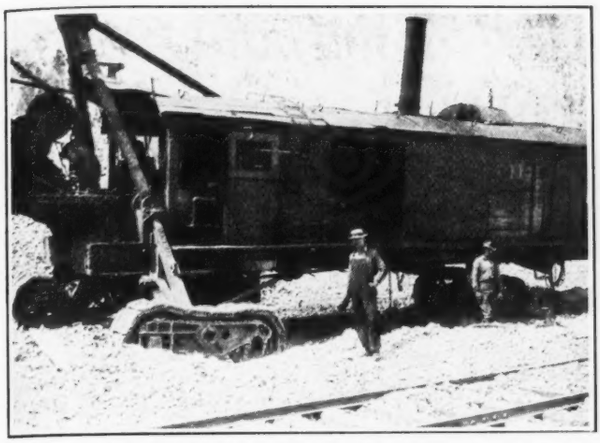
At the time I visited the pit, twenty shovels were employed in day operation and six at night. The day shift begins at 6 a.m. and the night shift at 4 p.m. All of the twenty-three shovels except two, which are electrically operated, are steam shovels. The greater number consist of 91 Model Marions. In addition, Atlantic and Bucyrus types are employed. Twelve shovels are equipped with manganese steel, 4½-cu.yd. buckets of the Mesabi type; one has a 5-yd.; two have 2½-yd., and the remainder are provided with 3½-yd.

Electrically operated shovel in ore

buckets. All of the shovels are equipped with Bucyrus caterpillar tractors except two of the Atlantic type and two No. 60 Marions. One electrically operated shovel is equipped with direct-current and the other with alternating-current motors.

For transporting overburden, ninety 30-yd. Clark cars are employed. For coal service 12-yd. Oliver cars are used. For ore handling, 800 80-ton steel cars are available, which includes those in use and those in the repair shop. These cars were formerly of the bottom-dump type, but have been largely converted to solid-bottom cars, which are dumped at the mills by revolving tipples. Locomotives exceed fifty in number, including twenty-six 50-ton (16 by 24) Porter four-driver type, five 15 by 24 Porters, two (9 by 10) Baldwin tender-type, and seven Baldwin switch engines (22 by 26) of different weights. In addition, two 20-ton and one 120-ton locomotive cranes are in use. Four spreaders, two of the Bucyrus and two of the Jordon type, are available for use upon waste dumps.

The details of ore and waste handling equipment have been enumerated chiefly because of the extremely large quantities that are handled. A maximum output of 45,000 tons of ore can be maintained with the present equipment, part of which is necessarily in the shops for repair. Although twenty shovels are operated in ore and overburden, ten could load 30,000 tons per day economically. The requirements of selecting ore from different parts of the pit and in varying



Steam shovel showing caterpillar tractor equipment

Electrically operated shovel loading cap rock

amounts to maintain a specified shipping grade imposes a condition that increases the amount of active equipment over that required merely for loading.

The most important recent change in equipment was the introduction of caterpillar tractors in place of railroad trucks on the steam shovels. This change increased the mobility of the shovels and practically eliminated the shovel pit crew. It also enables the shovels to retreat back from a caving bench rapidly enough to escape piling up at the front of the shovel. Delays in moving to a new working position are eliminated. The tractors can be removed from a shovel and replaced by railroad trucks, and the shovel taken from the pit, in a day. The shovel can be returned to the pit in one and a half days.

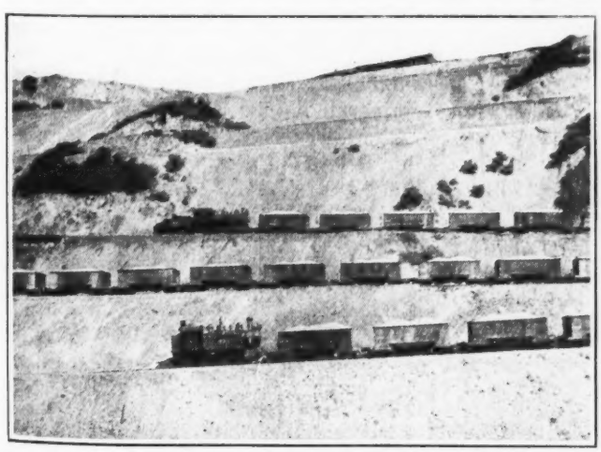
The two electrically operated shovels were introduced for experimental purposes. They have been so successful that all of the shovels are to be electrically equipped, and the steam engines and boilers will be discarded. This change will reduce the traffic on the hill by eliminating the necessity for coal distribution. It will save power but not labor. It is of interest to note that after an exhaustive test of direct-current and alternating-current installations, the decision has been made to use alternating-current equipment. Differences in maintenance costs led principally to this decision.

The amount of equipment and the severe service to which it is subjected necessitate well-equipped repair shops. Two principal shops in charge of a master mechanic are maintained, one for shovels and locomotives and the other for cars. Each is under a separate foreman. Roundhouse service for locomotives is also provided. A drill sharpening shop is placed on one of the upper levels near the compressor plant. Power is delivered at 44,000 volts to transformers near the compressor house and stepped down to 5,000 volts. It is stepped down to 440 volts at the points required. A 5,000-volt line supplies current to the two electrically operated shovels.

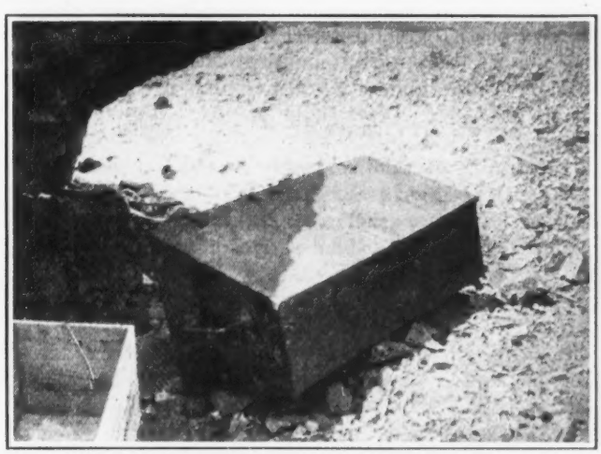
Labor difficulties have been overcome by an employees' general committee consisting of three men from each of the eight departments who are elected by the men in the department. One man serves for a year and the other two serve for six months, the man securing the highest vote taking the year term. The committee meets once a month by itself and once a month with the management. An accident and welfare man is in charge of the safety work.

The company carries its own compensation insurance. The employees maintain an Employees' Welfare Association which gives aid and assistance to its members as needed. This is supported by small monthly payments. In addition, an athletic association plays its part. Recently the Utah Copper Co. erected a magnificent club house, called the Gemmell Memorial Building, in Bingham Canyon, for the enjoyment of the employees. A feature of this building is a well-appointed gymnasium.

Acknowledgment is made of the courtesy of the company and L. S. Cates, its general manager, and his assistants, who patiently helped me in gathering the data for this article.



Transporting ore down hill over series of switchbacks. Three trains moving down



Fuses are stored in iron boxes placed in protected positions away from powder magazines

Intersecting Fracture Zones and Mineral Districts

Geological Interpretations of Value to Prospectors

By Charles A. Porter

AMONG MINERS of half a century ago it was the common belief that ore deposits occurred within regions of weakness in the earth's crust. This principle proved of limited worth to them, however, as every mountain range marked a line of extensive fracturing, and it was no difficult matter to find hundreds of square miles of such disturbed areas that failed to show even faint indications of mineralization. These early-day adventurers observed a more definite indication in the presence of "porphyry," and this, along with fissuring, became the recognized accompaniment of mineral deposits. Later the geologists elaborated and refined the "porphyry" idea, adding the principle of deep-seated solutions, the final result being the igneous theories of today. Little attention has been paid, however, as to why ore-forming igneous agencies have chosen one locality in preference to many others that might easily be considered just as favorable.

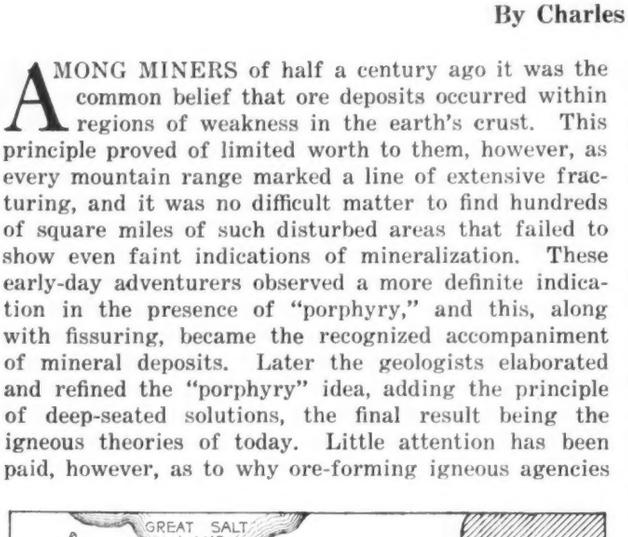


Fig. 1—Location of mining districts near east-west line of uplift transverse to north-south ranges

Adapted from U. S. Geological Survey topographic maps

Many mountain ranges display huge scarps that could not exist without faulting extending to great depths. Yet these faults are commonly barren for their entire length. It is the object of this paper to throw some light upon these questions and to point out some conditions that mark the differences between mineral and non-mineral lands.

Park City District at an Intersection

Beginning at a point marked by the Park City mining district, in the Wasatch range in Utah, which strikes northerly and southerly, another range known as the Uintah Mountains extends about one hundred and fifty miles easterly. The Wasatch and Uintah ranges, in common with mountain ranges in general, mark lines of faulting and folding, and it may be significant that the Park City mining district occurs where the line of the Uintah disturbance enters that of the Wasatch range.

The line of easterly and westerly fracturing does not terminate as it enters the north and south break, but it evidently continues through the Wasatch range; and after swinging slightly southward, passes through the Park City, Cottonwood, Alta, and American Fork mining districts. It crosses the lowlands west of the Wasatch, and becomes again a topographical feature in the form of a ridge of such magnitude as to divide these lowlands, north and south, into the Salt Lake and Utah valleys. This condition may be seen by reference to Fig. 1, based on parts of the Salt Lake and Tooele topographical sheets of the U. S. Geological Survey. The ridge, in a manner similar to the Uintah Mountains as they reach the Wasatch, is in turn lost as it enters the Oquirrh range, the latter lying parallel to the Wasatch and about fifteen miles from it. A ridge again appears on the western side of these mountains, dividing the lowlands, as before, into two separate valleys, known respectively as the Tooele and Rush valleys. Then we again find this ridge is also lost as it enters the Stansbury range. The cross fracture seems to end here, and there appears to be no evidence of its existence in the lowlands further west.

A pronounced widening of the Stansbury Mountains will be observed opposite where the ridge meets the range. This condition also occurs in the Oquirrh and Wasatch mountains. Along with this widening the greatest elevations are to be noted in all three of the ranges. From these observations it seems there can be little doubt that the cross fractures were factors in determining the character of the north-south ranges at these points.

Phenomena of Intersecting Mineral Areas and Fracture Zones

In the Oquirrh Mountains, the Mercur (Lewiston), Ophir, and the Bingham Canyon districts are found. This is illustrated by Fig. 1. The deposits at Bingham occur from one to three miles south of the spot marked Bingham, which is the site of the old depot at the lower and northern end of the town. Though these deposits are in the area of the uplift and widening of the range, it will be noted that they are not directly in the path of the cross fracture, but there is evidently a connection between the widening of the range and the cross fracture, and presumably the deposits as well. The phenomena of mineral districts occurring at or near intersecting zones of disturbance are exceedingly common in the Basin Region of the western part of the United States, and this peculiarity of not being in what appears to be both lines of maximum movement is also of frequent occurrence. The reason for this is, perhaps, not impossible to determine, but it will not be discussed here, as this paper will be confined as closely as possible to a statement of facts.[1]

[1]Since writing the foregoing, my attention has been called to the tenth chapter of "The Ore Magmas," by J. E. Spurr, where the general argument outlined here and the influence of the Uintah Uplift has been discussed. It has been deemed advisable, however, to make no changes in the present paper upon the Uintah discussion, as the subject has been approached from a different point of view. The reader should also note that there is evidence in "The Ore Magmas" which has not been touched upon here.

Fig. 2 is based on a portion of the topographical sheets of the Virginia Quadrangle, showing the location of Virginia City, Nev., which rests directly on the apex of the Comstock Lode. It will be seen that the lode occurs where the northeasterly and southwesterly Flowery range abuts against the northerly and southerly Washoe range. In this case we have not merely the intersection of a range and a ridge, or some smaller geological feature, but, instead, the intersection of two fully developed mountain ranges. The extent and intensity of the mineralization of the lode is well known, and it may be that the degree of mineralization was not entirely dissociated from the magnitude of the intersecting fracture zones. This is a feature that will be touched upon later.

Examples in the Southwest

Other instances of the occurrence of ore deposits at the intersection of fracture zones may be easily cited. In the Cerbat range, north of Kingman, in Arizona, a heavy mineralized belt occurs, the ores containing zinc, lead, gold, and silver. The mineralized area extends diagonally across the range from Stockton Hill to the town of Chloride, a distance of about twelve miles. To the northwest of Chloride and along the strike of the mineralized zone, a ridge is again found dividing the lowlands into the Detrital and Sacramento valleys, and to the southeast, on the extension of the mineral belt in that direction, a succession of buttes appear, their tops being still above the deep detritus of the Wallapi Valley. The intensity of the cross-fracturing is difficult to estimate in this instance, as the terrain is old geologically and has evidently been subject to unusual erosion. That the cross-fracturing has extended far beyond the region of mineralization is again evident, as in the cases of the Comstock Lode and the Uintah break.

An old district which has produced considerable quantities of lead-silver ore, and which is situated in the Pilot range in northwestern Utah, and known as the Tecoma district, affords another example of ores occurring at the intersection of fracture zones. About two miles north of the mineralized area the mountains decrease abruptly to a line of low hills and buttes, which continue along the strike of the range toward the northeast, and another line of hills branching further back toward the deposits forms a "Y" with the range. The ores in this instance occur directly where the prolonged strike of the two lines of hills would intersect. The northwest fracture is marked at its junction with the main range by conspicuous volcanic plugs and craters. This line of fracturing can be traced northward until it enters the edge of what probably should be called the Toano range, as the latter swings to the east at this point, the meeting of the line of hills and the Toano mountains being marked by the presence of a low grade lead-silver deposit, which is known as the "Jackson Mine," the mine having made shipments of ore at various times. The northeast line of hills continues for perhaps ten miles, where it also encounters an easterly and westerly range, at a point which is locally reputed to contain deposits of tungsten.

An Illustration From Nevada

The Delano district, in Elko County, Nev., which has been producing lead-silver ores for the last forty or fifty years, is another example of a ridge intersecting a mountain range, the ridge evidently being the continuation of a range which ends abruptly about two miles northeast of the mineralized area. This district exhibits an unusual condition. The main workings are in the crotch of two prominent spurs, and to a casual observer these spurs would seem to indicate cross fractures. The northwest-southeast spur has been formed, however, by the lifting action of large masses of intrusives, and it does not extend beyond the influence of the local disturbance; hence this fracturing could not have been a preliminary factor in the formation of the deposits.

The Bonanza King mine, in San Bernardino County, Calif., occurs at the intersection of the Hackberry and the Providence ranges. The Providence range trends

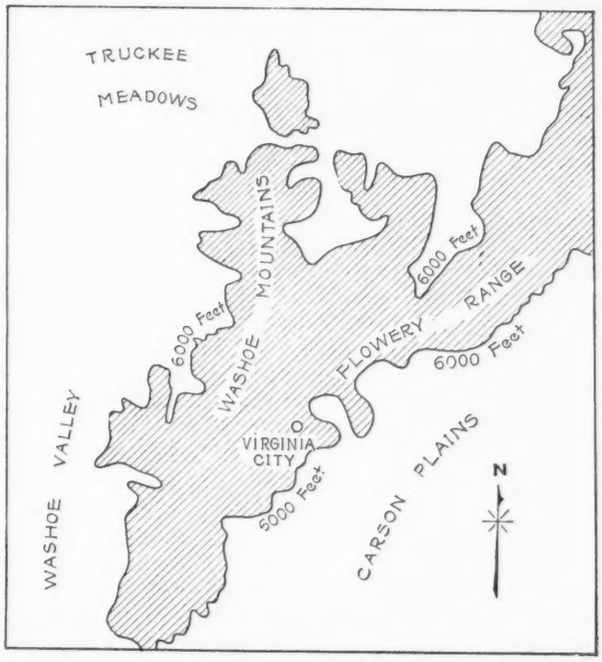


Fig. 2—Location of Comstock mines (at Virginia City), at intersection of the north-south Washoe range and the northeast-southwest Flowery range

Adapted from U. S. Geological Survey topographic maps

northeasterly, and the Hackberry range lies easterly and westerly. This mine is an old one, its large dumps attest considerable former activity, and it is reputed to have produced some very rich silver ore.

In the study of intersecting fracture zones and their effect upon ore deposition another class of cross fractures was early noted. These were such as form lines of weakness across mountain ranges, and by affording conditions favorable to more rapid erosion than the main portion of the range, have resulted in the formation of "passes." These "passes" have some common characteristics. They are usually broad, with their bottoms relatively flat. They cross the ranges in straight lines, although not necessarily at a right angle, without displaying the sinuosities of the normal canyon, and do not show the common tendency to narrow down just before the summit is reached. They seem to result from transverse stresses within the range itself, and show no evidence of the fractures extending beyond the flanks of the mountains. These conditions are often associated with granitic intrusions, and are frequently accompanied by small amounts of ore. The mineralization of eight different cases of this class which have come under my notice has ranged

from irregular small stringers to deposits that have paid moderately for their stoping; but in no instance has a deposit been noted that realized the entire expense of mining. Hence, it cannot be said that, as far as observed, a "mine" has resulted under these conditions.

Theoretical Considerations

Why this occurrence of intersecting mountain ranges, and other evidences of cross-fracturing in connection with mineral districts, has been ignored in the general literature of ore deposits is a question difficult to answer. So, also, is the failure to realize the significance of the much-studied Comstock Lode, occurring at the junction of two mountain ranges. It must be evident that the examples adduced in this paper cannot be mere coincidences, nor can other and more numerous instances that have come under my notice. Indeed, it is difficult to find epigenetic deposits in the West that do not show some evidence of cross-fracturing that has existed prior to the local igneous activity, and which also extends far beyond the possible influence of the latter. This statement is made in the light of ten years' experience and observation after the idea of intersecting zones was first conceived. It may not be impossible that cross-fracturing is the essential forerunner of ore deposition. The Basin region itself is a network of intersecting fractures. In it are a succession of parallel north and south ranges which abut against the northwesterly Rockies on the north end, and the southeasterly ranges that begin with the Sierras and continue along into Mexico on the south end. Within the Basin itself cross ranges also occur. The Excelsior range in southwestern Nevada, and the uplift that crosses northern Nevada and southern Idaho, as well as the Uintah break, are examples to the point. In South America, Peru has been the locus of extraordinary deposits. Is it an accident that the straight line of the Andes Mountains from the south is abruptly shifted to the west and forms a shoulder in the South American continent? Or is this sudden change the result of a side thrust and cross-fracturing on a huge scale? And if the latter, did this fracturing constitute the first step toward the mineral deposits of the country?

Another point of pronounced mineralization in the Cordillera occurs in Alaska. It will be remembered that running outward from the Aleutian peninsula a chain of islands extends westward until it meets the Kamchatka peninsula of Siberia. This line of islands, and the peninsula also, is a region of earthquakes, and evidently follows a zone of fracturing which, from its influence upon the topography of Alaska and its remarkable continuity, must be the result of extensive and deep-seated causes. It should be pointed out that the eastern shore of Asia is in a general straight line with the Rocky Mountain system. This may readily be seen by looking downward from a point above the North Pole upon a common terrestrial globe. Hence the Aleutian disturbance forms a great curve with its two extremities resting on an uplift that has been influential in the forming of the western coast of America and of eastern Asia.

It will be seen from the foregoing that the Cordillera form a succession of intersections excepting in the southern part of South America. The Sierra Nevada presents similar conditions for its entire length. It intersects with the Basin ranges toward the south, as has been pointed out in the foregoing, and shows cross-fracturing with the Siskiyou Mountains in northern California, the latter range evidently being associated with the uplift across northern Nevada, as it lies in the same strike. In the states of Washington and Oregon, despite the immense size of the Cascade range, there is an almost entire absence of ore deposits, as well as a scarcity of intersecting mountain ranges. The northern parts of the Appalachian range have shown only a few scattered deposits, and there appears to be no general mineralization excepting at the southern end, where considerable gold has been mined. But here again evidence of intersecting fractures is found. Upon a relief map prepared for the United States Museum by Edward F. Howell, and modeled in 1893, an elevation is shown extending directly west from the western flank of the Appalachians in northern Alabama and continuing halfway across the State of Mississippi. This elevation is nearly 150 miles long, and forms a divide over its entire distance, sharply separating the drainage into north- and south-flowing streams. The western end of this uplift is lost as it enters the Mississippi Valley. It is to be noted, however, that on the opposite side of the valley, about two-hundred miles distant and directly along the same strike, the clearly demarked southern edge of the Ozark uplift is to be seen. It is not impossible that these uplifts are only parts of the same disturbance.

Effects of Erosion

The suspected denudation here closely resembles a condition at Oatman, Ariz. The deposits in the latter place are upon the western slope of the Black range. In Oatman proper they occur along a line of northwest-southeast fracturing which meets the line of north-south fracturing of the range. The Gold Road mine, about one mile northward, and the Gold Ore, still further in the same direction, occur under the same conditions. The northwesterly fractures evidently belong to the same system. As these fractures extend west they approach the Colorado River valley, and any former irregularities that may have resulted from the movement that made the northwest fissures would have been swept away in the intense erosion to which the valley region has been subjected. On the opposite side of the river, a mountain range may be seen with its end scoured away until it is lost in the common level of the valley, affording an example of what appears to have occurred in the Mississippi Valley.

Telephone Companies Large Copper Users

In the telephone and telegraph systems of the United states alone, more than 800,000,000 lb. of copper are already employed, according to the Copper and Brass Research Association. The world's telegraph and telephone systems have already consumed 1,300,000,000 lb. of copper, and are now using it at the rate of 200,000,000 lb. additional each year. The world also is girdled by 20,000,000 lb. of copper in submarine cables.

Into our American street-railway systems has gone 675,000,000 lb. A ten-car subway train alone contains about 40,000 lb. of copper; an ordinary street car 2,500 lb.

Most people think of a steam locomotive as the iron horse, but 3,000 lb. of copper have entered into its construction; and about 100,000,000 lb. goes annually into the journal boxes of railroad freight and passenger cars in the form of bearings.

Washing Residues from Copper Ore Leaching

Some of the Principles That Are Involved and How Calculations Are Made

By G. D. Van Arsdale
Consulting Chemist and Metallurgist

IN THE TREATMENT of copper ores by wet methods, after the leaching operation, it is obviously not possible to make a complete separation in one step of the solution and the treated residue. If one is leaching by percolation, after drawing off as much as possible of the main solution, the leached ore will retain more or less solution, proportional to its moisture-retaining characteristics and the fineness of crushing. If the treatment is by agitation, then drawing off as much solution as possible after settling will leave more or less of the main solution remaining with the residue, depending on its settling characteristics. Therefore a part of practically all leaching processes is the recovery, by some method of washing, of as large a percentage as possible of this residual solution.

This necessity for washing, of course, involves the production and handling of quite large amounts of wash solutions, all of which are more dilute, and some much more so, than the main solutions. Because evaporation is usually not practicable, on account of its cost, these dilute wash liquors cannot usually be raised to the same strength as the main solutions, and their handling is a serious problem for any leaching method. This is particularly true when, for example, the main precipitation operation is electrolysis, as the plating out of copper from very dilute solutions is usually not practicable. In such a copper-leaching flow sheet, therefore, the alternatives are offered of treating the dilute wash liquors by some other method, such as iron precipitation, or of handling them so that they can be kept in balance and absorbed into the main solutions. The first involves the so-called solution discard, which, although sometimes unavoidable, is usually objectionable because of the production of a considerable amount of cement copper at usually a higher cost per pound than by the main electrolytic method.

Elementary Principles of Washing

Some uncertainty appears to exist as to the theory of washing, and especially as to the possibility of maintaining constant total volumes of solutions in any leaching method, and what is elementary in what follows to those familiar with the subject may therefore be excusable. A complete discussion of washing would be too long for present consideration.

Maintaining a constant total volume of main solutions and washes without any discard is entirely possible under favorable circumstances, and this result, which is of course desirable, depends on the following simple conditions: In leaching any copper ore, with respect to the soluble constituents other than copper, one has obviously the following cases:

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For ores coming under (*a*) a discard *must* be made, for obviously a constant accumulation of the dissolved material in question would otherwise result, finally resulting in saturation. Many ores come under this class, but there are also large amounts of ore of the second kind, and with such ores, it is possible to maintain constant total volumes without discard under proper operating conditions. This is obvious from the following: Assume any total volume, say a gallons, of main leach liquor; assume any number n of separate washes of volume b gallons each; assume that the moisture in the incoming ore is equal to the evaporation per cycle; and assume that all washes are equal in volume, and also equal in volume to the fresh water added per cycle and to the volume of moisture discharged with the tailing. Under these conditions, operate by adding in each cycle the first strongest wash to the main solution, and for

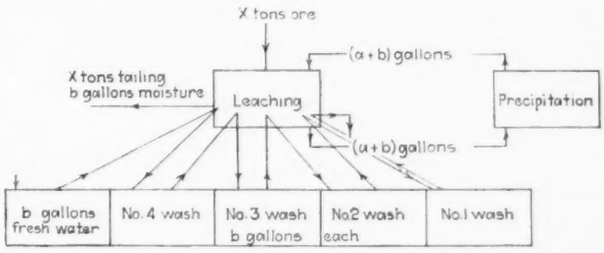

Fig. 1—The maintenance of constant solution volume, moisture in tailing equal to fresh water added.

successive cycles, advance each wash, the second wash for the first cycle becoming the first strongest wash of the second cycle.

At any time, under these conditions, the total volume of solutions and washes will be $(a + nb)$ gallons, and as in each cycle b gallons of fresh water is added, and the same amount of b gallons is discharged with the tailing, constant volume evidently will be maintained. When the moisture in the ore is greater or less than the amount of evaporation per cycle, a corresponding adjustment must be made in the unit volume of new fresh water per cycle. Of course, also, when the moisture in the incoming ore is more than the evaporation, the difference between incoming moisture and evaporation must be sufficiently less than the unit volume to permit of a sufficiently large unit volume of fresh water. Provided the above conditions are maintained, the conclusion as to the maintaining of constant volume holds true for percolation, agitation and decantation, or agitation and filtration. The diagram printed above, Fig. 1, illustrates the foregoing.

Some leaching methods require definite percentages of reagents in solution other than the acid which is the

from irregular small stringers to deposits that have paid moderately for their stoping; but in no instance has a deposit been noted that realized the entire expense of mining. Hence, it cannot be said that, as far as observed, a "mine" has resulted under these conditions.

Theoretical Considerations

Why this occurrence of intersecting mountain ranges, and other evidences of cross-fracturing in connection with mineral districts, has been ignored in the general literature of ore deposits is a question difficult to answer. So, also, is the failure to realize the significance of the much-studied Comstock Lode, occurring at the junction of two mountain ranges. It must be evident that the examples adduced in this paper cannot be mere coincidences, nor can other and more numerous instances that have come under my notice. Indeed, it is difficult to find epigenetic deposits in the West that do not show some evidence of cross-fracturing that has existed prior to the local igneous activity, and which also extends far beyond the possible influence of the latter. This statement is made in the light of ten years' experience and observation after the idea of intersecting zones was first conceived. It may not be impossible that cross-fracturing is the essential forerunner of ore deposition. The Basin region itself is a network of intersecting fractures. In it are a succession of parallel north and south ranges which abut against the northwesterly Rockies on the north end, and the southeasterly ranges that begin with the Sierras and continue along into Mexico on the south end. Within the Basin itself cross ranges also occur. The Excelsior range in southwestern Nevada, and the uplift that crosses northern Nevada and southern Idaho, as well as the Uintah break, are examples to the point. In South America, Peru has been the locus of extraordinary deposits. Is it an accident that the straight line of the Andes Mountains from the south is abruptly shifted to the west and forms a shoulder in the South American continent? Or is this sudden change the result of a side thrust and cross-fracturing on a huge scale? And if the latter, did this fracturing constitute the first step toward the mineral deposits of the country?

Another point of pronounced mineralization in the Cordillera occurs in Alaska. It will be remembered that running outward from the Aleutian peninsula a chain of islands extends westward until it meets the Kamchatka peninsula of Siberia. This line of islands, and the peninsula also, is a region of earthquakes, and evidently follows a zone of fracturing which, from its influence upon the topography of Alaska and its remarkable continuity, must be the result of extensive and deep-seated causes. It should be pointed out that the eastern shore of Asia is in a general straight line with the Rocky Mountain system. This may readily be seen by looking downward from a point above the North Pole upon a common terrestrial globe. Hence the Aleutian disturbance forms a great curve with its two extremities resting on an uplift that has been influential in the forming of the western coast of America and of eastern Asia.

It will be seen from the foregoing that the Cordillera form a succession of intersections excepting in the southern part of South America. The Sierra Nevada presents similar conditions for its entire length. It intersects with the Basin ranges toward the south, as has been pointed out in the foregoing, and shows cross-fracturing with the Siskiyou Mountains in northern California, the latter range evidently being associated with the uplift across northern Nevada, as it lies in the same strike. In the states of Washington and Oregon, despite the immense size of the Cascade range, there is an almost entire absence of ore deposits, as well as a scarcity of intersecting mountain ranges. The northern parts of the Appalachian range have shown only a few scattered deposits, and there appears to be no general mineralization excepting at the southern end, where considerable gold has been mined. But here again evidence of intersecting fractures is found. Upon a relief map prepared for the United States Museum by Edward F. Howell, and modeled in 1893, an elevation is shown extending directly west from the western flank of the Appalachians in northern Alabama and continuing halfway across the State of Mississippi. This elevation is nearly 150 miles long, and forms a divide over its entire distance, sharply separating the drainage into north- and south-flowing streams. The western end of this uplift is lost as it enters the Mississippi Valley. It is to be noted, however, that on the opposite side of the valley, about two-hundred miles distant and directly along the same strike, the clearly demarked southern edge of the Ozark uplift is to be seen. It is not impossible that these uplifts are only parts of the same disturbance.

Effects of Erosion

The suspected denudation here closely resembles a condition at Oatman, Ariz. The deposits in the latter place are upon the western slope of the Black range. In Oatman proper they occur along a line of northwest-southeast fracturing which meets the line of north-south fracturing of the range. The Gold Road mine, about one mile northward, and the Gold Ore, still further in the same direction, occur under the same conditions. The northwesterly fractures evidently belong to the same system. As these fractures extend west they approach the Colorado River valley, and any former irregularities that may have resulted from the movement that made the northwest fissures would have been swept away in the intense erosion to which the valley region has been subjected. On the opposite side of the river, a mountain range may be seen with its end scoured away until it is lost in the common level of the valley, affording an example of what appears to have occurred in the Mississippi Valley.

Telephone Companies Large Copper Users

In the telephone and telegraph systems of the United states alone, more than 800,000,000 lb. of copper are already employed, according to the Copper and Brass Research Association. The world's telegraph and telephone systems have already consumed 1,300,000,000 lb. of copper, and are now using it at the rate of 200,000,000 lb. additional each year. The world also is girdled by 20,000,000 lb. of copper in submarine cables.

Into our American street-railway systems has gone 675,000,000 lb. A ten-car subway train alone contains about 40,000 lb. of copper; an ordinary street car 2,500 lb.

Most people think of a steam locomotive as the iron horse, but 3,000 lb. of copper have entered into its construction; and about 100,000,000 lb. goes annually into the journal boxes of railroad freight and passenger cars in the form of bearings.

Washing Residues from Copper Ore Leaching

Some of the Principles That Are Involved and How Calculations Are Made

By G. D. Van Arsdale
Consulting Chemist and Metallurgist

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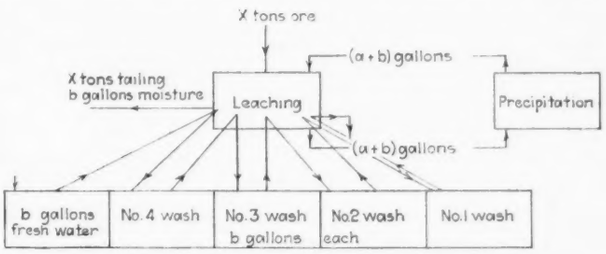

Fig. 1—The maintenance of constant solution volume, moisture in tailing equal to fresh water added.

successive cycles, advance each wash, the second wash for the first cycle becoming the first strongest wash of the second cycle.

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Some leaching methods require definite percentages of reagents in solution other than the acid which is the

usual solvent. Iron is an example, and there are practicable conditions under which any reasonable percentage of iron may be kept constant in the main solutions without a discard. Under other conditions, a discard may be required, or iron in some form must be added. When, however, the conditions of case *a*, above, exist—that is to say, more soluble constituents are dissolved than are discarded with the final tailing moisture—uniform solution composition can be maintained only by a discard, and to compensate for this discard, obviously an equal amount of fresh water must be added to avoid depletion of volume. This case therefore requires more fresh water per ton of ore than when no discard is necessary; that is to say, if operating with a unit volume of b gallons for all washes, and an accumulation of any solution constituent that can be corrected by a discard of c gallons per cycle is found, then the new fresh water volume for each cycle must be raised from b gallons to $b + c$ gallons. The unit volume of the remaining washes will then depend on the point at which the discard is taken out. Thus, in the diagram, Fig. 1, if the discard of c gallons is made from the No. 4 wash, it may be compensated for by raising the new fresh water an equal amount, and the remaining washes may still be kept at b gallons each. If, on the other hand, the c gallons were discarded from the No. 1 wash, after being

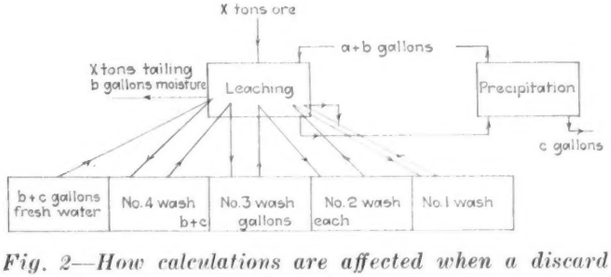


Fig. 2—How calculations are affected when a discard is made.

treated by the main precipitating operation—for example, electrolysis—then the unit volume of all washes will have to be raised to $b + c$ gallons. This last case may be illustrated by a second diagram, Fig. 2.

The two preceding diagrams are for leaching systems using dry crushing, which is practicable down to a limit of say about 8 to 12 mesh. In finer sizes than this, the disadvantages of dry grinding will usually make wet grinding more desirable. For some problems, however, consideration of fine grinding and treatment by agitation instead of by percolation is warranted, and for such cases the washing problem is different from that with dry crushing preceding the operation of leaching. If water is added at the head of such systems during fine grinding, the total solution volumes cannot be kept in balance unless a discard is made equal in volume to the water added per cycle in the grinding operation. When no discard is otherwise required by accumulation of solution constituents and it is desirable not to make a solution discard, a system can have its total volume kept constant provided the wet grinding is done either in solution or in the required amount of one of the washes, this amount then forming a closed circuit which will accordingly have no unbalancing effect on the main solution closed circuit, or on the balance obtained in the remainder of the cycle.

In a leaching system, using percolation either upward or downward, there are two alternative methods of applying washes—by circulation washing or by piston or displacement washing. By circulation washing is meant putting a unit volume of wash on a charge of ore, drawing this off, and pumping it on again until the solution assays become constant, and then removing the unit volume, to be followed by the next wash in the same way. Solution assays may be calculated approximately for this method of washing. Thus, if the main solution volume left on the ore is equal to the unit volume of wash added, and the assay of the main solution is x per cent of any constituent, and the assay of the following wash is y per cent of the same constituent, then the assay of the resulting mixture and of the unit volume drawn off will be x per cent plus y per cent divided by two. The total recovery of values will of course be conditioned by the number of washes.

Assuming a main solution carrying 3 per cent copper, one fresh water wash and four other washes, and say 15 per cent moisture discharged with the tailings and remaining after each wash, there will be 0.5 per cent copper in the final tailing moisture, corresponding to a dissolved copper loss of 1.5 lb. per ton, as follows:

	First Cycle	Second Cycle
First wash;	solution remaining 3.0 per cent Cu. wash added.....2.0 per cent Cu.	
Second wash;	solution remaining 2.5 per cent Cu. wash added.....1.5 per cent Cu.	Wash advanced 2.5 per cent Cu to main solution
Third wash;	solution remaining 2.0 per cent Cu. wash added.....1.0 per cent Cu.	Wash advanced 2.0 per cent Cu to No. 1 wash
Fourth wash;	solution remaining 1.5 per cent Cu. wash added.....0.5 per cent Cu.	Wash advanced 1.5 per cent Cu to No. 2 wash
Water wash;	solution remaining 1.0 per cent Cu. wash added.....0.0 per cent Cu.	Wash advanced 1.0 per cent Cu to No. 3 wash
Solution remaining.....	0.5 per cent Cu.	Wash advanced 0.5 per cent Cu to No. 4 wash

The solution remaining with the tailing as moisture carries 0.5 per cent copper, and by definition is 15 per cent by weight of the tailing and therefore equal to 300 lb. One-half of one per cent of 300 is $1\frac{1}{2}$ lb. per ton, which is the dissolved copper loss under these conditions, equal to 0.075 per cent copper.

The above tabulation leads to some interesting points, which show the results theoretically possible by this method of washing. The following will be seen to be true if 15 per cent moisture is allowed to remain after each wash, according to the above tabulation:

After draining off:	Lb. Copper per Ton Remaining	After draining off:	Lb. Copper per Ton Remaining
Main solution....	9.0	Third wash.....	4.5
First wash.....	7.5	Fourth wash....	3.0
Second wash....	6.0	Final wash.....	1.5

That is to say, each wash takes out an equal number of pounds of copper per ton of ore, and if the number of washes is n, the pounds of copper left as dissolved copper loss will be the pounds left before washing divided by $n + 1$, in this case 6, and the recovery of soluble copper by the five washes will be 7.5 divided by 9, or 83.33 per cent.

Also, it can be seen that the assay of the final moisture will be the assay of the original solution divided by $n + 1$, in this case 3 per cent divided by 6, equaling 0.5 per cent, and each advancing wash is successively stronger by this amount of 0.5 per cent. General expressions may be made for any system using this method of circulation if the conditions are strictly observed. For example:

For any main solution assaying x per cent and any

number of equal washes, n, of unit weight b lb., circulated to constant assay, and with tailing discharged with b lb. moisture, there will be:

Pounds copper remaining after draining off main solution	$\frac{xb}{100}$
Pounds copper remaining after n washes of b lb. each, and water wash of b lb.	$\frac{xb}{100} \div (n + 1)$
Assay of final moisture discharged with tailing, per cent.	$\frac{x}{(n + 1)}$
Assay of first wash advanced, per cent	$x - \left(\frac{x}{n + 1}\right)$
Assay of second wash advanced, per cent	$x - 2\left(\frac{x}{n + 1}\right)$
Recovery of dissolved values =	$\frac{\left(\frac{xb}{100}\right) - \left(\frac{xb}{100} \div (n + 1)\right)}{\frac{xb}{100}}$

For example, under the above-noted conditions, and a main solution of 2.5 per cent copper instead of 3 per cent, and four washes plus a water wash, the tailing moisture will assay 2.5 per cent divided by 6, equaling 0.416 per cent, and equivalent to 1.248 lb. dissolved copper loss, compared with 1.5 lb. as shown in the tabulation from a solution carrying 3 per cent copper followed by the same number of washes.

It should of course be understood that the above is general only for the specific conditions outlined, and is therefore illustrative only. For any given set of conditions, however, provided these are rigorously followed and kept consistent, similar general expressions may be worked out. Practically, the calculated results will be modified by any departures from the outlined conditions, and by the uniformity with which they are applied. Calculations of the sort may be useful practically; for example, in plant design one can be quite definitely certain of the pounds of copper per ton of ore recoverable by any number of washes, and knowing the approximate cost of one wash can calculate the advisability of an additional wash. Also, in plant operation, one has a guide as to the limits within which the assays of the individual washes must be kept for uniform and highest extractions.

Obtaining the Highest Efficiency

It can also be shown mathematically, as explained fully in Julian and Smart's "Cyaniding Gold and Silver Ores," that the highest extractions for any given amount of wash liquor will be had when the total volume is divided into equal volumes of washes; also, that for any total wash volume, the highest efficiency will be had when this volume is divided into the greatest practicable number of washes. These statements, and others made by the authors in the chapters referred to, are general and apply to either decantation or percolation. Mechanically, so far as these principles are concerned, there is no difference between washing after cyaniding and washing after copper leaching.

What Is Meant by Displacement Washing

Piston or displacement washing was mentioned above. This means drawing off the main solution until it reaches the ore level, and then following this with successively applied washes, without circulation. Practically, upward percolation is probably preferable for applying solutions for the purpose of leaching or dissolving, because the air entrained in the ore is thereby pushed to the upper surface, with less channeling resulting. Replacement washing may be either upward or downward also, but theoretically it is better to wash downward. The efficiency of this method of piston washing compared with circulation washing is largely dependent on a minimum of mixing of solutions and washes with the preceding solutions, and it is probable that there will be less mixing in applying a light solution onto the top of a heavy solution than if the reverse is done.

Relative Effectiveness of Displacement and Circulation Washing

Theoretically, also, with the same total volume and equal number of individual washes, displacement washing is more efficient than circulation washing, and, properly applied and controlled, will be found to be so in practise. This can be seen from the following: If no mixing whatever took place, and if complete replacement at the surfaces of particles occurred, one water wash would make a recovery of all of the remaining dissolved values. Practically, of course, this is never even approached, since mixing always occurs and complete replacement is not possible. However, it is obvious that the most inefficient example of replacement washing will be that in which there is complete mixing of incoming wash with residual solution. This however, is precisely the circulation washing, previously mentioned, and it is evident that with anything less than a complete mixing, replacement will be more efficient than circulation. There will be a zone of mixing between the two solutions in contact which should be more or less constant in width as the solutions move downward, and the washes should be applied so as to keep this zone of mixing at a minimum.

Importance of the Speed of Washing

The speed at which the solutions pass downward is controllable within limits, and this rate has a considerable effect on the efficiency of washing. A bed of ore may be considered as made up of a great number of passages varying in size from microscopic to the largest distance between individual particles. Under these conditions, as the solutions will travel by the easiest way, a rate of percolation may be reached at which all of the wash will go through the largest interstices, leaving the solution unaffected in the smaller ones, while at lower rates more and more wash will go through the smaller passageways and thereby give more efficient washing. For any ore or set of conditions the rate of percolation to give most efficient washing can be determined only experimentally, but the importance of this point is evident. Exactly the same principle applies to leaching, and for some ores it has been found necessary to reduce the percolation rate to zero—that is, to allow the solution to remain in contact with ore without moving for a time.

No large copper-leaching installation at present uses ore crushed to a size fine enough to permit of agitation. There are problems, however, in which fine grinding and agitation may be required in later practice. Methods of calculation for extractions for washing by this method have been published. For copper leaching it is probable that fine grinding and agitation will come into use generally, provided a thoroughly acid-proof mill for grinding in solution can be developed.

Marketing of Ocher

How an Important Mineral Product Is Handled

By A. H. Hubbell
Managing Editor

OCHER is a mineral of importance in the manufacture of paints and colors and linoleums. It has minor uses, also, such as the coloring of stucco, cement, floor tiles, and the like. In composition it is a limonite or hydrated sesquioxide of iron and may be mixed with clay, silica or other impurity, necessitating washing to remove it. It occurs as a loose, finely divided, pulverulent material, mixed with fragments and boulders of rock, and is easily mined and washed. In color it is yellow, varying from dull brownish shades to a beautiful golden hue. The shade varies with the locality and depends on prevailing conditions. The iron oxide content ranges from around 9 or 10 per cent Fe_2O_3 to more than 60 per cent.

Color and tinting strength are the qualities of ocher most important to the trade. Its iron content is also considered, though to a much less degree.

Two Producing Countries

France and the United States are the chief sources of the ocher on the market. Compared with lead or copper mining the industry is small. The output of French ocher amounts to possibly 30,000 tons a year. Of this about 10,000 tons is imported into the United States, where it is used for paint and color purposes, very little of it going into the manufacture of linoleum. Only the better grades are imported. French ocher enters through New York, Philadelphia, and Baltimore and occasionally through other ports. Small quantities are imported from England, Germany and Italy also. The ocher is sold by representatives of producers, and by importers, jobbers, and dealers. With regard to both foreign and domestic ochers, it is difficult to differentiate between the actual producers and the jobbers.

About 25,000 tons of washed ocher is produced annually in the United States. Half of this comes from the Cartersville district in Georgia, and the greater part of the remainder from Pennsylvania. Two companies, one of which is located in the Cartersville district and one in Easton, Pa., produce roughly twice as much as all other domestic producers combined. These are the Georgia-Peruvian Ochre Co., of Cartersville, and C. K. Williams & Co., of Easton. Among the other producers are the New Riverside Ocher Co. and the Cherokee Ocher Co., both of Cartersville; Henry Erwin & Sons, of Bethlehem, Pa.; and Atlas Mineral Products Co., of Allentown, Pa. Virginia, Alabama, California, and Vermont complete the list of ocher-producing states.

New York, Easton, and Cartersville are the principal marketing points for the domestic output. The greater part of this is sold directly to the consumer, though much of it, particularly smaller lots, reaches the consumer through dealers and jobbers. Linoleum manufacturers, who customarily take a large part of the domestic output, are situated almost exclusively in Pennsylvania and New Jersey, with one plant in New York. On the other hand, consumers of ocher in the paint and color manufacturing industries are widely scattered.

Since color is so important a quality of ocher, the presence of any impurity that may affect it is to be avoided, if possible. Practically the only opportunity to do this is at the time of mining. Ocher is mined by pick and shovel, either in open pits or underground. Boulders and other waste are discarded where possible, but washing is necessary to remove all the foreign material.

A varying amount of umber sometimes occurs. Present in the finished ocher it may darken or give it a mottled appearance. A small amount of umber occurs with all ocher of the Cartersville district. The umber is found in small pockets and in streaks in the ocher bed. When in pockets it is easily discarded in mining. When in streaks, however, it must be mined and washed with the ocher and thus goes into the shipping product. There is seemingly no remedy for this, and the grade of a producer's material depends upon the amount of umber in his deposit and whether it can be discarded at the time of mining.

Furthermore, in drying ocher after it has been washed, prolonged contact with hot surfaces is likely to darken the color of the ocher immediately next to the heating surface. This may spoil the uniformity of color of the product. Such darkening is ascribed to the loss by the limonite of some of its water of crystallization.

Method of Preparation Simple

Treatment in log washers, separation of the ocher as slime in classifiers, thickening, drying, pulverizing, and packing are the principal steps of the most up-to-date washing process. Where steam drying is employed, the ocher immediately next to the hot surface is likely to be darkened. Some more advanced operators are using a revolving steam drum. The ocher is in contact with the hot surface of the drum only for a short time, when it is scraped off, thus avoiding darkening.

At some plants the washing process is much more crude than the one that has just been described. After passing through the log washer, the ocher is often allowed to flow through sluice boxes, in which the sand settles, to be shoveled out later, the ocher itself running into settling vats. Considerable ocher remains in the sand, however, and if the latter is not saved for retreatment, a serious loss results.

Cartersville Ocher Preferred for Linoleum

The domestic ocher that is best suited for the manufacture of linoleum comes from Cartersville. All Cartersville, or "Georgia," ocher is not of the same grade, however. At least three grades are produced in the district, which turns out about 12,000 short tons per year. Of this, about 8,000 tons is of the first quality and is produced by one company. A screen

analysis of its products showed 97.98 per cent to be minus 350 mesh, 1.65 per cent minus 300 plus 350 mesh, and 0.57 per cent plus 300 mesh. The inferiority of the other grades is due principally to the presence of umber. Practically all of the best grade from the district is used in the manufacture of linoleum and is said to be preferred for this purpose both in the United States and abroad. Linoleum, it may here be explained, is made by laying a mixture of hardened linseed oil, ground cork, ocher, or other pigment on burlap backing, which is coated on the reverse side with iron oxide paint.

The term "Peruvian" applied to Cartersville ocher is meaningless. It was adopted originally as a trade name by one producer, but was never copyrighted and has been freely used by others in the district.

Other domestic ochers, while inferior to the best Cartersville grade for making linoleum, find a market for paint and color purposes, depending on their color and tinting strength. In iron oxide content none of them equals the Cartersville variety, which may run as high as 60 per cent Fe_2O_3.

For paint and color purposes, however, the finer grades of French ocher are superior to anything produced in the United States. In color, the French ocher may be had in numerous shades up to a brilliant golden yellow. That of the finest quality contains about 20-22 per cent Fe_2O_3, this in interesting contrast with the high iron content of the Cartersville variety.

How Ocher Is Sold

Ocher is always sold on the basis of a type sample, color and tinting strength being the important characteristics. It is not sold on analysis, though an approximate analysis may be given when requested. It is frequently stated in contracts by the producer that ocher is a "natural earth pigment and may vary 5 per cent either way." Samples submitted are matched against a standard or desired shade. This is done by mixing a portion of ocher with oil and "rubbing it out" on glass alongside the sample that it is to match. Tinting strength is determined by mixing one part of ocher and ten parts of zinc oxide with a definite number of drops of linseed oil, and determining the shade thus obtained. Obviously, an ocher costing 50 per cent more than another grade, but having double the tinting strength, is more economical.

Skill in buying ocher is largely a matter of training of the eye in matching shades and of selecting from samples a grade that will be satisfactory in color and tinting strength for the desired purpose. Such skill can be acquired only through experience.

Ordinary Forms of Contract Used

Ocher is handled in quantities ranging from a few barrels to carload lots. Some large producers deal usually in car lots only. Contracts are customarily made at the end of the year and may cover the entire ensuing year, the producer shipping a specified quantity monthly. There is no standard form of contract. Where buyer and seller have long-established relations, the contract may simply be a written order specifying quantity, grade, price, and delivery. More formal contracts for large orders stipulate grade, method of packing, quantity, price, terms, and delivery. Terms vary to suit both parties. Contracts commonly contain the clauses waiving responsibility in case of strikes or similar conditions.

For domestic shipment, ocher is packed in 400-lb. barrels lined with paper or in 224-lb. burlap bags for box-car loading. For export shipment, 430- to 450-lb. barrels are used. Barrels are usually made on the spot. A carload shipment contains fifteen tons (minimum).

Prices are usually f.o.b. cars. Georgia or Cartersville ocher of the best grade is quoted at $26 to $30 per ton (October, 1924), according as it is packed in bags or barrels. The difference is the cooperage charge. The poorer grades of Georgia ocher bring about $5 per ton less. Other domestic grades are cheaper and have a wide range of price. French ocher similarly has a wide range of price, the best selling as high, on occasion, as $45 per ton, New York, according to grade.

A duty of $\frac{3}{8}$c. per pound is levied on ocher, washed or ground, or $\frac{1}{4}$c. on crude or unground. The competition between foreign and domestic ocher is principally in the cheaper grades. The better qualities of French ocher are in steady demand for paint and color purposes, and, on the other hand, the best Georgia ocher is preferred to any other, foreign or domestic, for linoleum manufacture.

Hybrid Spanish for the Miner

The technical Spanish of the average Mexican miner of the Southwest is a subject worth the attention of the connoisseur of idioms. It is a curious brand of Spanish, with the addition of a number of English words, the latter being used for mining terms whose Spanish names are not generally known or are too long for convenient use. The following phrase is a good example: "No chansa por dump, chansa por hacha." It was said by one Mexican to another regarding dumping a car at a raise, and its purport was that an axe would have to be used on the timbers around the raise before the car could be dumped. The expression may be a lingual crime, but it possesses the advantage of being understandable both to those of us who took, not very seriously, a year of Spanish in college and to the Mexicans who understand little English. Expressed in pure Spanish the phrase would not be understood by a large majority of the English-speaking members of the mine's personnel and if said in good English it would have no significance to most of the Mexicans—or at least no apparent significance. The average local representative of the glory that once was Spain is extremely loath to use English as a medium of conversation even when he does understand it.

A common expression in the mine is "El raise esta lleno"—The raise is full. A soft-spoken boss is known as "Manchita"—the gentle one. A tool nipper is a "zorra," literally a fox. A stoper is a "chicharra" because it sings like a cricket. The local English name for a jackhammer is plugger, which the Mexicans have modified to "plugga"—the change in the last syllable presumably being made for euphony.

The following note was found tacked to a chute: "Por el pueble de la tarde—trenen los chutes, limpien el traque y no sean quepones." "Trenen" comes from the verb "tronar," to thunder. Its underground meaning is to blast. "Chutes" is an English word and "traque" is an adaptation of track. "Quepones" is "huebones" (lazy), misspelled. A chute blaster translated the message thus: "For the afternoon shift—blast the chutes, clean the track, and do not be lazy!"

Impressions of the Mining Congress at Sacramento

By T. A. Rickard

THE TWENTY-SEVENTH CONVENTION of the American Mining Congress was a pleasant and useful affair; it gave many of us an opportunity to meet old friends; it enabled others to ventilate their ideas before an intelligent audience, and it renewed historic interest in the days of '49. The meeting at Sacramento started with a parade of prospectors, burros, stage coaches, and bewhiskered citizens, all of which served to remind the visitors that gold was first discovered in California at a spot near the capital city; and two days later a revival of an old-time mining camp at Auburn, 36 miles away, served further to recall the days of the Argonauts. Of all the sights the one that would have most astonished Sutter or Marshall was a Chinaman driving an automobile.

The proceedings of the first evening were enlivened by the singing of the glee club from Grass Valley, but they were marred by two speeches in which an effort was made to boost one Presidential candidate at the expense of another. To those not of the same political persuasion as the speakers, these lapses into partisanship must have been irritating. It was in bad taste. Mining conventions are not political meetings. The *Sacramento Bee* called it "a Coolidge Political Boost Meeting." A greeting to the convention from the President was read; the firm grasp of industrial problems and the split infinitives suggested that the letter had been written by the Secretary of Commerce.

The first general session, next day, left a much better impression. The president of the Congress, Mr. H. W. Seamon, delivered an acceptable address, recounting, among other things, some of the useful work done in behalf of the industry by the organization of the Mining Congress, at Washington, and incidentally giving those present a welcome opportunity to testify their regard for Mr. J. F. Callbreath, the secretary of the Congress, when his name was mentioned by his titular chief. Mr. Seamon emphasized the fact that one of the duties of his organization was to check ill-considered legislation; but it is not, he insisted, "a lobbying agency"—which is merely a splitting of hairs. A lobbyist is a person that buttonholes legislators for purposes of persuasion. The act is not nefarious, nor even impolite. The word "lobbying" exactly describes part of the useful work done by the officers of the Mining Congress in Washington, and they may as well accept it as properly descriptive.

A reference to the "late lamented McFadden bill" led Mr. Seamon to assert that "nothing is more certain than that its opponents were in error." He insisted that it would have averted "a needless disaster to the mine workers"; it was, in his opinion, "flawlessly framed," and, "if passed, the gold industry today would have been on an even keel." As against this view of the matter, we have Mr. W. J. Loring's statement, made before the same convention two days later, that out of sixty-five representative men, especially versed in the subject, to whom he submitted a questionnaire, not a single one approved the idea of reviving the demand for a bonus on newly produced gold.

Mr. Seamon's reference to the use of lime arsenate to destroy the boll weevil in the cotton fields reminds me of the best thing that was said at Sacramento. After the president had spoken, a number of speeches were made by representative men, one of whom was Mr. P. G. Beckett, manager for the Phelps Dodge Corporation. He delivered an eminently sensible talk on the status of the copper industry, and ended by suggesting that perhaps what it needed most was a boll weevil. This was apropos of the memorial said to have been proposed by the planters of the South in gratitude to the parasite that reduced the production of cotton, and thereby restored its market price. No truer word was ever said in jest. Mr. Beckett doubted whether the cost of producing copper, in Arizona, could be reduced; he deplored the high rates for freight and wages, as well as the excessive burden of taxation, and he concluded that, in view of the enormous domestic consumption, the only further relief to the market—outside the boll-weevil cure—must come from a revival of trade in Europe as a sequel to the adoption of the Dawes plan. The large output was necessary to meet the high cost of operations—hence overproduction. "We don't want obstructive help from the government," he exclaimed, "in the shape of restrictive legislation." For the proposed tariff on copper he had nothing to say, being, of course, too wise to suppose that a duty on South American copper could have any result except to transfer the refining of it from the United States to England or Belgium, without having any beneficial effect on the market, in which the South American copper would continue to compete with our own production. So there remains only the boll-weevil cure!

Senator Tasker L. Oddie, of Nevada, made a pleasant speech; he spoke a friendly word for the Geological Survey, the Bureau of Mines, and the Senate Commission on Gold and Silver. An attempt to revive the McFadden bill had encountered "a stone wall," in the shape of a sinister influence at the Treasury Department. The re-establishment of a metal currency in Europe should, he said, prove helpful to the mining of the precious metals.

Mr. Falcon Joslin was chosen, most properly, to make a plea for Alaska; and he did it effectively. In twenty-five years Alaska has produced $350,000,000 in gold; and that, as he was well advised in reminding his audience, did not include the Klondike, which not uncommonly is assumed to be a part of Alaska. A territory of more than half a million square miles has now a population of barely 30,000 white people. At present the fisheries represent the chief industry, but wide scope for successful mining remains. Mr. Jesse McDonald, formerly Governor of Colorado, and identified with Leadville since 1878, spoke for his state, which has produced two billion dollars' worth of metals, of which a quarter has come from Leadville and nearly another quarter from Cripple Creek. He mentioned the help given by the tariff to the mining of tungsten, manganese, and other secondary metals; he referred to the expectation of developing new oil fields, and generally indicated that mining is on the mend in Colorado. A humorous speech followed from Mr. C. E. Neslen, of Salt Lake City. He reminded his hearers of Utah's high statistical status: first in silver, second in copper, and third in lead production in the United States last year. The Utah Copper Co. has paid 135

million dollars in dividends in fifteen years. Mr. Neslen boasted of the great men as well as of the great mines of Utah, and ended with a poetic effusion. Mr. R. E. Tally, manager of the United Verde, being absent, his paper was read by Mr. W. Val de Camp, recently appointed superintendent of the same mine. Mr. Tally's paper did not lose in its delivery by his friend, and it was a fit companion to Mr. Beckett's speech. He stated that the depression in copper mining was due to overproduction and unsystematic marketing; the intensive production during the war caused an abnormal increase of plant capacity, creating a burdensome overhead expenditure; the high-cost mines lost less by continuing to operate at a small loss than by closing down completely; that was the last resort. Curtailment should apply to low-cost as well as to high-cost mines, and should not be used as a club against the latter. General curtailment would increase the price of the metal, so that the low-cost mines would make as large a profit as from their normal production. On average, Mr. Tally remarked, one profitable mine emerges from 22,000 locations. The surtaxes kept money out of mining.

A reminder of our good neighbor to the North was forthcoming in a message from Mr. William T. Sloan, Minister of Mines for British Columbia: It was read by Mr. A. G. Langley, engineer for the Revelstoke district. The Province, we were told, needs both prospectors and capital. The old-time prospector is gone. The training of prospectors during winter has proved successful. The total mineral production of British Columbia to date has been $810,000,000. Liberal mining laws are in force, taxation is reasonable, and American capital is welcome.

Space will not permit me to say much about the subsequent sessions. Excellent papers may be noted on taxation by Mr. McKinley W. Kriegh, on the profits of oil production, by Mr. A. G. McLaughlin, and on the elimination of waste through standardization, by Mr. C. B. Lakenan. The establishment of a State Department of Mines was advocated by Judge John F. Davis in a speech delivered in his best style. Mr. H. Foster Bain was welcomed heartily when he explained the functions and activities of the U. S. Bureau of Mines, of which he is the efficient director. Dean F. H. Probert of the University of California delivered a fascinating address on the history of the Yuba gold fields, this being followed by an amusing incident. Mr. Seamon proposed that the address be printed in the Journal of the Mining Congress, whereupon Mr. Callbreath stated that the circulation of that journal was so small that perhaps it might be better to print Professor Probert's address in pamphlet form. It was so ordered. At the same session Mr. Loring spoke on the measures proposed for the stimulation of gold mining. This will serve as a text for my concluding remarks.

At such conventions as the one at Sacramento one obtains a fair measure of trustworthy information and sound philosophy, but there is also a considerable flow of loose talk and half-baked economics. The Mining Congress went wrong on the gold bonus, as proposed in the McFadden bill, largely because those who knew better lacked the courage to oppose it. At such meetings, as at the last, it is usual to hear vigorous expressions of opinion against "government in business"; it is insisted repeatedly that the development of the natural resources of our country has progressed marvelously under a policy of "hands off"; we are told that the greatness of the West is owing to individual initiative, and so forth. Nevertheless, concurrently there is voiced a demand for special legislation of various kinds, such as bonuses and protective tariffs. This desire for paternal aid from the Federal Government is inconsistent with the loud protest against governmental regulation and the vigorous insistence upon a free scope for individual initiative. Paternalism is spurned with one hand while maternalism is begged with the other. Just now the gentlemen in control of the Mining Congress feel that they must do something to retain the support of the gold miners, so they propose that gold mines shall be exempt from federal taxation, with the hope that similar immunity will be accorded later by the states and counties. The proposal is not only unsound economically but it is evidence of intellectual dishonesty. That is, of talking contrary to one's real knowledge.

The meetings at Sacramento were so crowded with papers and addresses that discussion was notably lacking, but it is unlikely that any well-considered objection to the proposal for exempting gold mines from taxation would have been received pleasantly. Those in control showed no patience whatever three or four years ago toward persons who were unwilling to support the McFadden bill. I speak advisedly. This new proposal is sure to meet with the same fate, because it deserves to do so. We of the mining profession wish heartily to see gold mining prosperous no less than Messrs. Seamon, Loring, Fletcher Hamilton, et al., but we are willing to face facts, one of which is that the mining of gold is a minor branch of the mining industry of the United States; moreover, we know that there is a plethora of gold in this country and in the national Treasury. This accumulation of gold is one factor in depressing the business of gold mining. Even in California the mining of gold is a secondary industry; the county of Los Angeles by itself produces annually more wealth in the form of oranges than all the gold produced in the whole of California. In our state, the mining of oil, of gas, and of cement are of greater industrial importance. These facts must be faced honestly.

The chief reason why gold mining is depressed is not high taxes, high labor, or lack of government aid; it is to be found in the fact that a few days before the Sacramento convention the chief brokerage houses of the United States offered bonds on the Masonic Temple in Chicago at 6½ per cent; the loan of money for erecting this office-building backed by good security, was made at a rate of interest so high as to render unattractive the speculation in gold mines. So long as gilt-edged investments can be made at 6 or 7 per cent, it is not likely that a sagacious man will risk his savings in a gold mine at 10 per cent, or even better.

All speculative activity in mines is suffering from the high earning power of money in less hazardous enterprise. That is the truth, however unpalatable. Rich men seek tax-exempt securities at 4½ per cent in lieu of starting new mines or smelters. Ask the Guggenheims why they are pulling their money out of mining. I remember when the Panama bonds of our government were oversubscribed, although the rate of interest was only 3 per cent; mining speculation was active then, naturally. It is a condition, not a theory, that confronts the leaders of the Mining Congress; they can serve the industry better if they rub their eyes and awaken to realities.

Discussion

"Engineering and Mining Journal-Press" is not responsible for statements or opinions published under "Discussion." In many cases the views expressed are diametrically opposed to editorial policy and belief.

Tungsten Producers Getting on Their Feet Again

THE EDITOR:

Sir—The article by Paul Wooton, published in the *Mining Journal-Press* of Sept. 13, regarding the effect of the tariff on the production of tungsten in the United States, is somewhat misleading and decidedly unfair to the owners of different tungsten properties that are getting back into production.

The extreme drop in the price of tungsten after the close of the war closed down dozens of tungsten properties, some of which had been equipped with large mills that had cost in the aggregate several hundred thousand dollars. In many cases the owners of the properties never recovered the cost of the milling plants. With the increased price of tungsten, many of these properties are being reopened, and the industry is certainly employing more than one hundred men at the present time. One property in the Nightingale district is building a large modern mill and expects to be in production soon.

I am manager of a company that is operating a large deposit of tungsten near Mina, in Nevada. This property has more than 80,000 tons of ore blocked out ready for milling; a mill is now being erected and the company will be producing concentrates in thirty days. This property alone, when fully developed and equipped, will be able to produce 100 tons of scheelite concentrates per month, and this is only one of several properties that are capable of large production when market and operating conditions are favorable.

With a fair price for tungsten, the mines of the United States can supply all the domestic demands and there will be no necessity to import a single ton of the ore. WALTER X. OSBORN.

Evanston, Wyo.

Credit to Mr. Ballard

THE EDITOR:

Sir—In your issue of Oct. 4 appears an article by myself entitled "Gold Veins of Sundry Areas in the Idaho Batholith." As the executive head of the Idaho Bureau of Mines and Geology I exercise too many editorial prerogatives of my own to be disposed, Mr. Editor, to question for a moment your editorial authority, "with all the rights, privileges and immunities thereto appertaining," as the college president's formula goes at commencement time. Nevertheless, inadvertently the blue pencil (or whatever color you may use) has in this instance deleted from my article all mention of my good friend and collaborator, Mr. S. M. Ballard, who rendered most valuable assistance, both in the field work and in the compilation of the report (Idaho Bureau of Mines and Geology Bulletin No. 7, "Geology and Gold Resources of North Central Idaho"), from which the article in question was largely drawn. Mr. Ballard is so extremely modest that he would be the last man in the world to feel he had been injured by such an omission, but this merely makes the obligation the more binding upon myself to call attention to the omission and to make abundantly clear the indebtedness which this article bears to him.

One rather small point may also be worth mentioning. The caption to the halftone on page 539 should be "Buffalo Hill diggings," not "Buffalo Hump"; glaciation in the vicinity of "the Hump" has rendered placer accumulations impossible. The digging in question is near Elk City. FRANCIS A. THOMSON.

Moscow, Idaho.

Still Working at Paracale, in Philippines, Despite Report to the Contrary

THE EDITOR:

Sir—In your issue of June 28, you publish an article headed "Benguet Consolidated Principal Producer in Philippines," in which the following statement occurs: "The gold-dredging operations at Paracale and Sirigao have ceased owing to exhaustion of the areas."

I am in a position to state that the information respecting Paracale is altogether inaccurate, for the reason that I am personally in charge of dredging operations in Paracale that have continued unbrokenly since 1911, and at present two dredges belonging to my company are in steady operation in the vicinity of the town of Paracale, and, moreover, we owe not one cent in the Philippine Islands that could not be paid on ten minutes' notice.

With reference to Sirigao (presumably Surigao): as the only dredge ever erected in that province worked for a few months only, it seems strange that exhaustion of the area should be accountable for its stoppage. I am not, however, qualified to give any information respecting this dredge.

The company has taken out, since commencing operations, about 3,750,000 pesos' worth of gold, much of it under great difficulties during the war, which was eventually the cause of three of the dredges closing down in 1919, but one ran on continuously, and it has about 50,000 oz. of gold to its credit, as a digger. In 1920 it started to redredge previously worked ground, and has taken out since that over 9,000 oz. One of those laid up in 1919 resumed dredging in August, 1922, and since that date it has dredged out about 8,700 ounces.

Paracale is kept going by the dredges, and had they "ceased," as your correspondent states, it would have had hard times for a few years past. Any person qualified to write notes *of any kind* about Paracale, knows quite well that dredging has *not* ceased in the district. WILLIAM TELFORD.

Paracale, Philippine Islands.

Abandonment of "Pittsburgh Plus" a Milestone of Progress

THE EDITOR:

Sir—You say (Oct. 11) that "Pittsburgh Plus" is abolished—not that it makes any difference because it had been abandoned anyway; and that "the vast majority of steel sold in the United States is unaffected."

This depreciates the importance of an industrial decision of the utmost moment. In times of overproduction "Pittsburgh Plus" was frequently abandoned temporarily, because of competition. That was one way of cutting prices; it gave concessions to the buyer without reducing the price at the mill. Nobody anticipates that "Pittsburgh Plus" was really abandoned as a policy to be used when practicable by all the steel makers, until the Trade Commission ruled it unlawful and the Corporation accepted the ruling. It would have come about again when and as surely as demand began to approximate productive capacity.

I wonder at the mental reactions of a writer who says that the vast majority of steel sold is unaffected. True, the production of Corporation mills only is directly subject to the order, and this alone in bars, shapes, plates, rods, and wire and wire products. But if the Corporation quotes on mill base its competitors must; indeed, they have done so. There was no recourse if they intended to stay in business. And as to products, there is little aside from rails that is unaffected.

What the West has wanted in this matter was to do away with tribute to Pittsburgh and railways reaching there. There are two kinds of consumers of steel—ultimate consumers and consumers for purposes of manufacture. We forget the first sometimes; you seem to completely. Trade policy had built around Pittsburgh the great center for the latter class of consumers. At the same time the ultimate consumer was moving further and further afield, as is shown by census population studies. If raw materials had to be hauled to Pittsburgh and the resulting product then hauled further and further away to reach the man who finally used it—as nails, perhaps, or freight cars, or ships—there was continually increasing a traffic congestion and an added unnecessary and uneconomic cost. It was shown that the concentration of fabricating plants about Pittsburgh cost the people several hundred million dollars in freights on steel alone during the war, which would have been avoided had there been no "Pittsburgh Plus" to build up there the center of the fabricating industry and had this industry been scattered nearer the ultimate consumer. This was on steel fabricated there and shipped to far points, especially West, to be made into war materials. This cost reached further than dollars of freight paid on steel alone, but ran into a resulting congestion on railways that was detrimental to all classes of business.

The West never had and never could get its full share of the consumers for fabrication so long as "Pittsburgh Plus" remained a possibility; whether or not a constant practice made no difference. The mere fear that it might be invoked was enough.

It is true that the region west of both Chicago and Duluth, especially Duluth, is agricultural and not industrial, and so consumes only as an ultimate consumer; but the farmer can no more afford to pay a price for steel products that is in excess of what it ought to be than can the skyscraper builder in New York City.

You say that the long drawn out controversy ends with a victory for no one. Do you overlook the fact that "Pittsburgh Plus" is abolished and that the protestants against it contended only for abolition? This matter is deeper than you think. It touches many fields. Years ago in a case brought in Illinois the principle of regulation of grain elevators was laid down. Who would now go back to the old system of unregulated elevator weights, grades, and charges? Later, railway rates were subject to regulation. Who would now go back to the rebates, bribes, and dishonesties that flourished all down the line under the old system?

Here is a case that has occupied four years of time; 20,000 pages of testimony have been taken, and arguments covering hundreds of pages more have been made. Yet you dismiss it in a stickful of superficial and contemptuous words as a matter of exceeding unimportance. If blazes along the trail of human progress are of no worth to a people looking for a path to equal rights, then this ruling is as you say.

Duluth, Minn. DWIGHT E. WOODBRIDGE.

Cyaniding Carbonaceous Gold Ores an Old Problem

THE EDITOR:

Sir—The reminiscences of Paul T. Bruhl, of San Juancito, Honduras, on cyaniding carbonaceous gold ores, faintly calls to my mind the earnest but unsuccessful efforts of the late Godfrey Doveton in his attempts to secure better than 78 per cent extraction on the cyanidation of the old fill from the Bonanza vein of the old Esperanza mine, in the El Oro district in Mexico. This oreshoot, known locally as the Veta Negra, was between black carbonaceous shale walls, and the reprecipitation in the pachucas during my period of employment by the company would almost make one cry.

Several years ago on a trip over the California Mother Lode with the late Roger Knox, of the Black Oak mine, in Tuolumne County, we visited the Belmont Shawmut mine, then operated by the Tonopah Belmont Co. They were treating a sulphide mined in carbonaceous shale, and I faintly remember that one of the flotation reagents was added to the tube-mill circuit, the object being to "sicken" the shale and prevent reprecipitation. As I remember it, they were quite enthusiastic about the results they were obtaining at that time. It was my intention to write to Paul Avery, then metallurgist for the Esperanza mine, of this method of treatment, but I learned, as they say here in California, that Esperanza was "going hay-wire," and I have not thought of the matter since. ROBERT J. BURGESS.

Yankee Hill, Calif.

"Magma" and Ore Chemistry

THE EDITOR:

Sir—An article and a letter on the above subjects in your issue of Aug. 16, on pages 250 and 263, respectively, greatly interest me. Both these contributions are along the line of thought that quite a few of us have been lately following—but it is only seldom that one sees the data quite so lucidly presented. Thanks are due to both Mr. Lewis and Mr. Hixon.

As regards deep-seated mineralization (or surface ditto of deep-seated origin) the latter gentleman's thesis seems the most clear, logical, and convincing that I have yet seen in print. A. SPENCER CRAGOE.

Liskeard, Cornwall, England.

News of the Week

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Summary

ACCORDING to E. J. Cornish, its president, the National Lead Co. has not increased its holdings in the Llallagua tin mines, in Boliva, in connection with the recent incorporation in the United States of Patino Mines and Enterprises, Consolidated.

Bandits are reported to have murdered B. F. Barker, auditor for the Erupcion Mining Co., and eight others in northern Chihuahua, Mexico.

A twenty-year contract has been closed whereby the A. S. & R. Co. will operate the Victorio properties at San Luis Potosi, in Mexico.

Noranda Mines, Ltd., controlling the Horne gold-copper properties in northwestern Quebec, has increased its capitalization to $15,000,000.

During the third quarter the Jib Consolidated Mining Co. earned $163,924 at its Montana properties.

Excellent results in prospecting at Pierce City, in the Joplin-Miami district, warrant the erection of a concentrator by the Eagle-Picher Lead Co.

The Tonopah Extension company has obtained an injunction stopping the West End Consolidated from continuing development under certain claims.

Construction of new mine plants is a feature of current activities on the Gogebic range in the Lake Superior iron region.

The Union Minière is said to have declined overtures of American copper interests regarding Katanga copper mines.

Tonopah Extension Enjoins West End from Development

Apex Litigation May Ensue—Claims Wrongful Extraction Under New Jersey and Panther Claims

Boom conditions in the Tonopah district in Nevada received a setback on Oct. 7 when the Tonopah Extension Co. filed a complaint in the Seventh Judicial District Court of Nevada, in Goldfield, against the West End Consolidated Mining Co., the Tonopah "76" Mining Co., the West End Extension Mining Co., and the Halifax Tonopah Mining Co. as defendants, stating in the complaint that to the best of its belief the defendant companies had entered into and under, and were extracting ore from within, the vertical boundaries of certain lode mining claims owned by plaintiff company. On plaintiff company's request a restraining order and an order to show cause was issued to restrain defendant companies from entering or working beneath the surface of the New Jersey and Panther lode mining claims of plaintiff company. The date set for the hearing was Oct. 17, but by mutual consent of parties thereto the date has been advanced into November, to permit examination and survey.

From available information it appears that the case is one of apex and extralateral rights. It is to be hoped that the differences can be settled out of court, thereby avoiding long and costly litigation. The filing of the suit has put something of a damper on development work throughout the entire district.

New Production Record for Tonopah Extension

TONOPAH Extension production at Tonopah, Nev., reached a new high for that company in September. During the month 14,516 tons of ore was milled and 272,670 oz. of bullion shipped, valued at $234,000. The largest previous month for this company was in April of this year when bullion valued at $225,600 was shipped.

Cannot Issue Stock Already Sold If Permit Is Suspended

Companies granted permits by the State Corporation Department of California cannot issue stock after their permits are suspended or revoked. This is the decision of U. S. Webb, state Attorney General, in a recent opinion prepared for the guidance of the State Corporation Department. According to the Attorney General, securities cannot be issued where permits are suspended or revoked, even though they may have been sold and paid for while the permit was in full force and effect.

Mace Smelter at Ouray

The Pennsylvania Mines Co., operating at Ouray, Colo., has completed the installation of a Mace smelting furnace of 50 tons' daily capacity. The plant will be operated in connection with the Bright Diamond and Wanakah mines, which belong to the company. Custom ore will also be handled, according to J. Van Damm, who is in charge.

Bandits Murder Mine Auditor and Train Crew

B. F. Barker, of Erupcion Staff, Carrying $15,000 Payroll, Is Victim —Americans in Band

B. F. Barker, auditor for the Erupcion Mining Co., which is operating in Mexico, south of El Paso, was killed by bandits on Oct. 10. Eight others were also killed according to reports.

A train of ore from the Erupcion mine on the Chihuahua & Oriente railroad was dynamited and wrecked by the bandits near Candaleria, 30 miles south of Juarez. Barker, who was among the passengers, carried $15,000 of payroll money. A rail had been removed from a curve in the track where trains run slowly. The engine, tender and a box car loaded with dynamite, left the track. The members of the train crew, eight in number, and Barker, were marched to a point near the rear end of the train, lined up and shot.

Immediately after the robbery the bandit gang gathered and was reported to have ridden into the hills in the direction of the Texas side of the Rio Grande. Three Americans and three Mexicans were in the gang, according to reports received in El Paso. Soldiers arrested two Americans on the highway leading to Juarez the following day, and they are being held at Villa Ahumada for investigation. They carried no loot, however, and federal troops are now searching the hills surrounding the scene of the wreck to intercept the bandits, who are believed to be on their way to the Texas side of the Rio Grande.

Leading Mines at Eureka, Utah, Use Wet Stopers Exclusively

THE mines of the camp of Eureka, Utah, are well equipped in the matter of sanitation and safety devices, according to the report of members of the Industrial Commission of Utah, who have, with the State Mine Inspector, been making an inspection of the camp. The Chief Consolidated and the Tintic Standard, the largest producers of the district, use nothing but wet machines, and it is said that other mines in the camp are not far behind in this respect.

Jib Consolidated Earned $163,924 During Third Quarter

The Jib Consolidated Mining Co. at Basin, Mont., in the month of September milled 7,244 tons, against more than 8,000 tons in August. Concentrate contained 4,015 oz. of gold, 22,382 oz. of silver, 38,300 lb. of copper, and 53,900 lb. of lead, for which the net smelter return was $81,600. Costs were $46,000 as follows: Smelting and freight, $7,000; mine development, $6,000; East Katie operations, $2,000; mining and milling operations, $31,000. Net profit for month, $35,600. The mill started to operate in second quarter of 1924, and profits for that quarter were $52,758.43 and for the third quarter, $163,924.39. Free gold has been encountered in a crosscut on the 400 level 70 ft. west of crosscut 413. The first car of ore shipped from the East Katie assayed $23 per ton and second car $36.70. In all, five cars have been shipped to the Anaconda smelter.

No. 2 ball mill in the mill has been relined and is handling better tonnage. Average mill heads for first twelve days in September were $18 per ton.

White Caps Will Sink Inclined Shaft Still Further

The shaft of the White Caps Mining Co., operating at Manhattan, Nev., is now 375 ft. below the 800 level, on a 45 deg. slope. Some vein material, which carried values as high as $30 per ton, was encountered at 350 ft. below the 800 level, but no work has been done on this ore showing. The company plans to sink the shaft several hundred feet deeper before starting lateral development on several levels, and this shaft work will require several months.

County Undertakes to Prevent High-Grading in California

The Amador County, Calif., Board of Supervisors has passed an ordinance regulating the sale of ores and bullion within that county. The buyer of such ores and bullion must keep a register of all purchases and must identify the seller and determine the source of the ore or bullion. Misstatement of fact by the seller is to be considered a misdemeanor under the ordinance.

National Lead Co. Does Not Control Patino Tin Properties

President Cornish Explains Relations With $50,000,000 Patino Mines and Enterprises Corporation—Joint Ownership in Williams-Harvey Concern

By A. B. Parsons
Assistant Editor

THE incorporation in the United States of Patino Mines and Enterprises Consolidated, a $50,000,000 corporation officered by E. J. Cornish, president of the National Lead Co. and his associates, has been interpreted as being the inception of a big "mine-to-finished-product" tin enterprise. This is a misapprehension, notwithstanding the fact that the holdings of the new company are large tin mines and mills and a railroad in Bolivia and that the National Lead Co. is the largest manufacturer of tin products in the world. The National Lead Co. does not control the Patino mines, nor does it purpose to invest any considerable part of its capital in mining enterprises, all of which necessarily have an inherent element of speculation.

Policy Against Mine Investments

The definite desire of the stockholders, as reflected in the policy of the directors, is to confine activities largely to manufacturing. As a matter of fact, the present officers of the Patino company are serving only temporarily, and they will retire in favor of Simon Patino and his South American associates whenever it is convenient to make the change. The National Lead Co. invested $1,500,000 in the properties two years ago and will doubtless retain representation on the board. When interviewed on the subject, Mr. Cornish explained the circumstances of the incorporation in this way: Señor Patino has long been the owner of the Uncia tin mine, the Machaca Marca & Uncia railroad, and an interest in the Llallagua mine. The two mines are situated on opposite sides of a mountain and the underground workings were connected a few years ago. The possibility of a dispute or litigation over orebodies, or of wrongful extraction of ore, produced an undesirable situation. Moreover, engineers showed that great economies could be effected by the operation of the properties as a single unit. The Llallagua was equipped with a more efficient milling plant, and engineers estimated that $400,000 annually could be saved by a merger. To facilitate such a merger, the National Lead Co. invested $1,500,000 in the Llallagua property at Señor Patino's solicitation, thereby giving him control of both mines as well as of the railroad.

Although the mines were in Bolivia, the various companies were organized under the Chilean laws. It was intended to form a single Chilean company to hold all the properties, but Chile early this year established a profits or income tax of 8 per cent, collectible from all corporations organized in Chile, irrespective of the source of the income. The United States, on the other hand, in the case of a domestic corporation whose income is derived from operations in a foreign country, permits the deduction of profit taxes paid to that country from the amount due under the 12½ per cent that it levies on incomes. Bolivia, the country in which the mines are situated, imposes a 20 per cent tax, so that, obviously, nothing is collectible as income tax from Patino Mines and Enterprises by the United States Government. That is the reason that the corporation was organized in this country, and the naming of the National Lead officials was merely a measure to facilitate legal procedure.

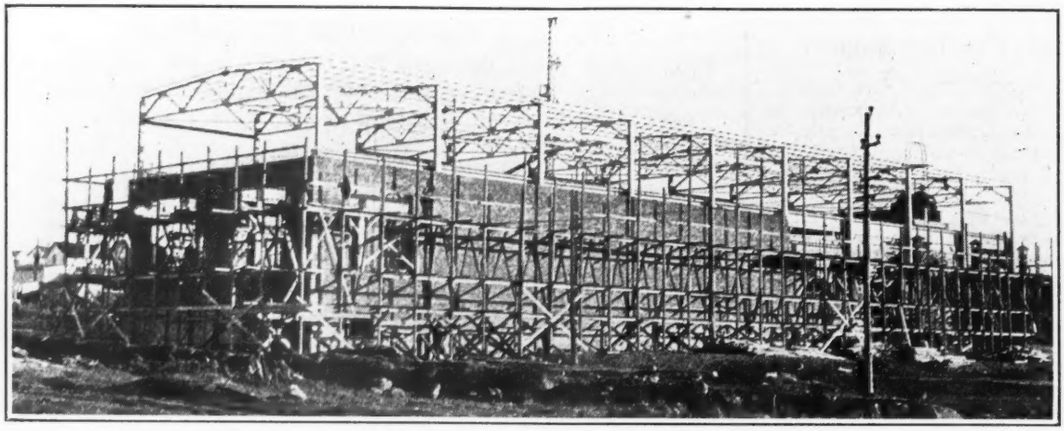
Another connection between the National Lead Co. and Señor Patino is the ownership by each of a one-third interest in the Williams-Harvey Corporation, which owns tin smelting plants at Brooklyn, New York, and in Great Britain. The Williams-Harvey Corporation has a long-time contract to smelt the entire output of the Patino mines. The Brooklyn plant, which started operation in 1918, was shut down in 1922 because it was cheaper, on account of lower wage scales, to smelt the ore at the British plants and ship the metal back to the United States.

There are no known commercial deposits of tin in this country, so there is no domestic mining industry to protect with a tariff. However, if there were a tariff on the importation of the metal, sufficient to offset the difference in the cost of smelting in this country, the tin-smelting plant on Long Island doubtless would be restarted. The National Lead Co., says Mr. Cornish, has never actively advocated or opposed a tariff on tin, or on anything else, for that matter.

World's Largest User of Tin

During 1923 the company imported about 25,000 tons of tin, or about half of the total imports. It is by a good margin the largest consumer of tin in the world. It is vitally interested in the mining of tin as well as of lead, zinc, and other raw materials. For this reason it desires to keep in close touch with the mining industries. This is accomplished by making comparatively small investments in various mining enterprises sufficient to warrant representation on boards of directors. However, mining is distinctly not one of the major activities of the company.

The Llallagua mine is the largest producer of tin in the world, and the Patino corporation will control about 75 per cent of the output of Bolivian mines. Bolivia is a close second to the Malay States in the production of the metal. The cordial understanding between the Patino company and the National Lead Co. doubtless will continue, to the mutual advantage of both, but the National Lead Co. is not, and, unless the present policy is changed radically, will not become, a dominating factor in the mining of tin.



New hoist and compressor building at the Asteroid mine on the Gogebic range

Kay Copper Opens Orebody in Arizona

The Kay Copper Corporation, operating at Canon, in the extreme southeast corner of Yavapai County, Ariz., 50 miles north of Phoenix, is said to have uncovered 30 ft. of sulphide ore in its crosscut from the 1,200 level from the No. 4 shaft, which was completed to that level last June. The orebody is believed to be the nose or northern extremity of the body cut in a crosscut from the 800 level some time ago. The crosscut on the 1,200 level is being pushed westerly at the rate of 12 ft. daily. Its main objective is the downward continuation of an orebody developed to the 600 level in No. 1 shaft, which lies 585 ft. northwesterly from No. 4, on the opposite or west side of the Agua Fria River. The crosscut from No. 4 should give 600 ft. of additional vertical depth and considerably more upon the dip of the orebody, which has an inclination of about 70 deg. to the west. Diamond-drill holes are also being driven in fan shape from the bottom of the 1,200 level. The Kay Copper Corporation is controlled by a combination of interests identified with the Mother Lode Coalition Company.

Eagle-Picher Abandons Wentworth in Favor of Pierce City

The Eagle-Picher Lead Co. is moving the old Gobbler concentrator, situated on the Gobbler mine, at Wentworth, Mo., to a new prospect near Pierce City, Mo.

Residents at Wentworth had hoped, when the big lead company took over the Gobbler property, that a revival of mining operations in the old Wentworth camp was to be expected. The contrary appears nearer the truth, as the removal of the Gobbler mill will make reopening of the Wentworth camp more unlikely than before.

The Eagle - Picher company has drilled all summer in the Pierce City section and is reported to have a fine prospect there. The ore is found at a shallow level, and it is understood incline shafts are to be used, with cars instead of cans for bringing the ore to the surface.

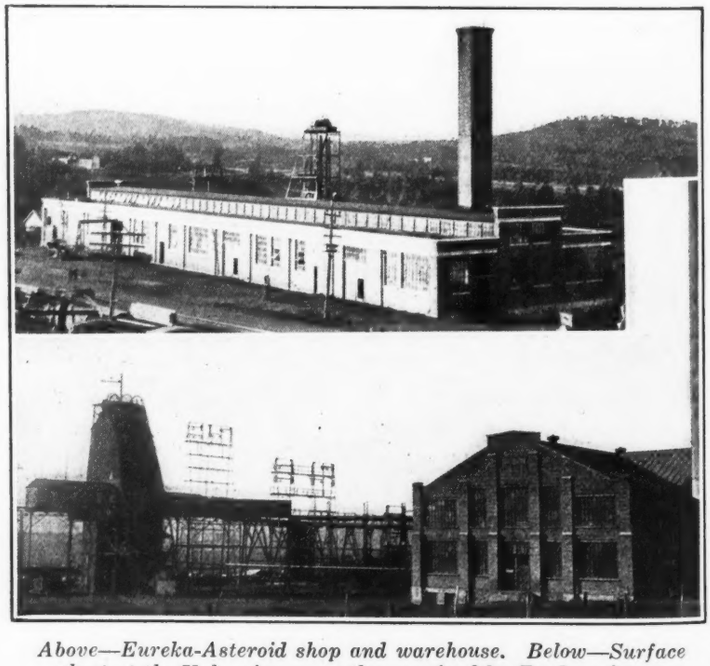
New Mine Plants Feature Gogebic Range

Asteroid Surface Building Approaching Completion—Ford Engineers Examine Yale Mine

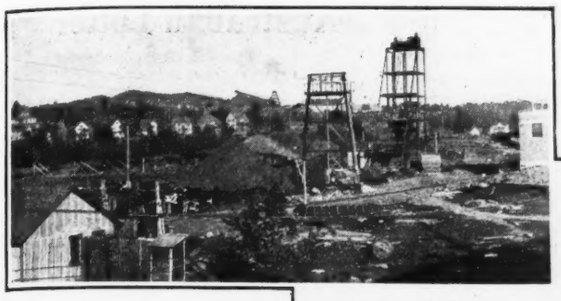
Although production of iron ore is below maximum on the Gogebic range, in Michigan, the operating companies are making large expenditures for sinking shafts and erecting new surface plants.

The Castile Mining Co. is sinking a new Asteroid shaft, in connection with which is a new shop and warehouse building to serve both the Asteroid and Eureka mine. A large new brick and steel building to house the hoisting and compressing machinery is nearing completion. One of the accompanying illustrations shows this structure and another the temporary headframe used in sinking operations. The new shop building will contain blacksmith, machine, and carpenter shops, a warehouse, a chemical laboratory, and a heating plant. A tunnel will connect it with the shaft.

Another photograph shows the steel headframe now being erected and some of the buildings about completed at the old "B" Norrie shaft. The shaft in the footwall on the Norrie "forty" was sunk by the Oliver Iron Mining Co., starting in 1901. It dips at 50 deg. down to the 14th level (1,177 ft.) and below there at 60 deg. to a total depth of about 2,000 ft. It has two hoisting compartments, and measures 5 ft. by 10 ft. 7½ in. inside of timbers down to the 14th level; below that it is longer, having one more compartment. It was formerly equipped with a wooden headframe and steam hoisting plant, but this was dismantled a few years ago when the Oliver company surrendered



Above—Eureka-Asteroid shop and warehouse. Below—Surface plant at the Yale mine, recently examined by Ford engineers



At left—
New shaft at the Asteroid, with temporary head frame

At right—
New surface plant at the "B" Norrie shaft, of the Republic Iron & Steel Co., at Ironwood

the lease on the Norrie. The company did, however, arrange to have the use of the shaft below the 14th level.

After passing through several hands the Norrie came under the control of the Republic Iron & Steel Co., which has been scramming hanging wall orebodies through the Townsite shaft situated on Oliver property. Office, shops, and most of the mining operations are soon to be transferred from this shaft to the new one.

The building on the left is the new office, then the change house and shops. Behind them is the engine house, which will contain electric driven hoists and compressors. Power is to be obtained from the Lake Superior District Power Co.

Engineers working for the Ford Motor Co. have been making a thorough examination of the Yale property, at Bessemer. Officials of Oglebay, Norton & Co., who are now managing the property, have not announced any agreement with the Ford company, but it is believed that negotiations have not gone beyond the making of this examination.

Idaho Maryland Options Brunswick at Grass Valley

The Brunswick mine, at Grass Valley, Calif., has been optioned to the Idaho Maryland Mines Co., a subsidiary of the Metals Exploration Co. The Brunswick mine holdings total about 27 acres in addition to 320 acres of agricultural land.

The mine was closed down in 1918, but has since been unwatered after equipping the shaft with a modern hoist. Several mining interests have examined the property since it was unwatered.

Silversmith Brings Dividend Total to $400,000

Silversmith Mines, Ltd., at Sandon, B. C., announces that on Oct. 10 it will distribute to the stockholders an additional dividend of $25,000, which makes the total to date $400,000.

In August the company shipped 400 tons of crude and concentrated silver-lead ore and 500 tons of concentrated zinc ore from the mine. The mine is producing from the 500, 800, 900 and 1,000 levels, and a station is being cut on the 1,200 level preparatory to crosscutting for the vein on that level.

Little Found at Hamilton, Nev., by Recent Prospecting

Reports from the Hamilton district, in Nevada, where the Tonopah Mining Co., as well as several other companies started work some months ago, do not indicate that anything of importance has been found. George H. Garrey has directed most of the recent work and has outlined development work which will prospect undeveloped areas containing possibilities. The Tonopah Mining Co. has done considerable crosscutting and drifting, as well as prospecting by means of long drills from development workings, and though some ore has been found available, reports do not indicate that important orebodies have been opened.

News from Washington

By PAUL WOOTON
Special Correspondent

U. S. Bureau of Mines Assigns Subjects For Metallurgical Research

Work Done Largely in Co-operation with Educational Institutions—
All Common Ores Will Have Attention—
Complex Ore Problems

ASSIGNMENT of metallurgical research to be conducted by the various stations of the U. S. Bureau of Mines has been made as follows: Ore-dressing research and experiments in sizing, crushing, and grinding; and service tests on metals used in connection with ore dressing and milling processes, Salt Lake City Station, in co-operation with the Department of Metallurgical Research of the University of Utah; metals used in crushing and grinding machinery, Minneapolis Station, in co-operation with the University of Minnesota; beneficiation of iron ores, Southern Experiment Station, in co-operation with the University of Alabama; flotation, Salt Lake City Station, in co-operation with the University of Utah; beneficiation of lead and zinc ores of the Mississippi Valley, Rolla Station, in co-operation with the Missouri School of Mines; classification of non-ferrous ores, Moscow Station, in co-operation with the University of Idaho and the operators of the Coeur d'Alene district; coal washing in Eastern and Central states, Pittsburgh Station, in co-operation with the Carnegie Institute of Technology and with coal operators; coal washing in the Pacific Coast states, Seattle station, in co-operation with the University of Washington; work with the experimental blast and electric furnaces and laboratory and field investigations in connection with the manufacture of iron and steel, Minneapolis Station, in co-operation with the University of Minnesota and with the industry; direct processes of steel manufacture, Seattle Station in co-operation with the University of Washington; open-hearth and bessemer processes, Pittsburgh and Minneapolis stations, in co-operation with the University of Minnesota and the industry; experiments with electric-furnace steel, Minneapolis Station, in co-operation with the University of Utah; problems of recovering gold and silver from their ores, Reno Station, in co-operation with the University of Nevada; utilization of silver and silver alloys, Washington, D. C., in co-operation with the Bureau of Standards; pyrometallurgy of copper, Tucson Station, in co-operation with the Universities of Arizona and of Utah; hydrometallurgy of copper, Tucson Station, in co-operation with the University of Arizona; pyrometallurgy and hydrometallurgy of lead, Berkeley Station; pyrometallurgy of zinc, Rolla Station, in co-operation with the Missouri School of Mines; hydrometallurgy of zinc, Berkeley Station; loss of metals in slags, Tuscon and Salt Lake City stations in co-operation with the Universities of Arizona and Utah; microscopic studies of complex ores, Salt Lake City Station, in co-operation with the University of Utah; aluminum research and electrometallurgical processes, Seattle Station, in co-operation with the University of Washington; physics, mathematics, and chemistry of metallurgical problems, Berkeley Station; metallurgical requirements for refractories, Seattle Station, in co-operation with the University of Washington and the Ohio State University; utilization of fuels, Pittsburgh Station; application of oxygen to metallurgy, Pittsburgh Station; applied physics and heat treatment of oil-well equipment, Minneapolis Station.

As a result of research and experimentation at the Seattle Station, officials now feel fully justified in announcing the feasibility of making in the electric furnace, high-grade foundry iron from steel scrap. Any manufacturer can use scrap from his plant and make castings equal to those made from cupola iron.

London Letter

By W. A. Doman

Special Correspondent

Union Minière Declines Reported Proffers From America

No Reason for Combining Interests—Plans Further Expansion of Operation in Katanga

London, Oct. 7—Some time ago I reported that American copper magnates were trying to acquire an interest in the Katanga copper fields, largely to provide against the time when the properties of the great producers in the States would approach the stage of exhaustion. Judging by news from Brussels it appears that negotiations had been resumed, for it is reported that financial deputations of the leading American and Canadian copper producers had made proposals at the head office of the Union Minière in Brussels to form a combination of interests, which proposal was declined. Great as the scale of operations in Katanga is, the company has yet larger schemes in view. As a result of these it is believed that copper can be produced at a price to defy competition. The question of marketing the metal is causing no anxiety, and the controlling interests are confident as to the future.

The Soviet Government has granted another mineral concession in the Priamur district of Siberia—this time to a Finn, on conditions somewhat similar to those accorded to the Priamur Syndicate, to which I recently alluded.

Dr. Malcolm Maclaren's full report of his investigation of the Shamva mine has now been released. Generally speaking, his conclusions are favorable. He says that the main body of the mine is at the intersection of the No. 7 and Eastern channels. This intersection should pitch steeply west-southwest, and the future of the mine in depth should lie broadly in that direction. The ore channels generally possess great strength and should persist unchanged so long as they remain in the quartzite. The depth of the quartzite is unknown, "but is probably to be reckoned in thousands rather than hundreds of feet." Originally, costs were estimated at 7s. 6d. a ton, but owing to the increased expenses of internal stopes, extra haulage and extra pumping, mining at depth necessitates a greater outlay, and the question of increasing the mill capacity is at present not a practical one.

The attempts to "bang" the shares of the Cam & Motor mine (Rhodesia) have not had great success. Latest cabled advices have been quite encouraging, particularly in No. 14 level, south of the Motor mine. At 129 ft. south from the winze at 528 ft. south, a crosscut toward the footwall has entered payable reef, the last 5 ft. assaying 38s. This does not allow too great profit, but it is interesting, especially as a further crosscut at 150 ft. south has cut ore assaying 47s. over a width of 9 ft., with the footwall not yet reached.

In connection with this company, an interesting transaction is reported to have just taken place. The Consolidated Gold Fields and its allied company, the Gold Fields Rhodesian, are said to have held between them 35,000 Cam & Motor shares, and at the last annual meeting of the Gold Fields Lord Harris stated that they expected good things from this investment. Now the statement is made that Sir Abe Bailey has purchased the whole block. It was he, it will be recollected, who came forward to finance the Cam & Motor when it was in rather low water, and as the mine has recently undergone a special examination by Dr. Malcolm Maclaren, it is presumed that Sir Abe is satisfied as to the prospects of the property.

Estimates Show Decline in Colorado Mine Production Except Gold and Copper

According to smelter receipts and deposits at the United States Mint, including the third quarter, the gold output of Colorado for 1924 will exceed by more than a million dollars that of 1923, when it reached $6,529,583 in value. The Cripple Creek district shows the largest increase.

The silver output for 1924, according to returns, will probably be less than half of the 4,449,925 oz. mined in Colorado in 1923. Copper will probably show a slight increase over 3,930,928 lb. mined in 1923. Indications are that the lead production will fall approximately 4,000,000 lb. below that of 1923, when the output was 42,445,620 lb. The value of the output from Colorado zinc mines in 1923 was $3,642,100, which is probably half a million greater than will be shown for 1924.

National Lead Co. Undertakes Mining in Leadville, Colo.

The resumption of the Fortune and Penfield properties on Little Ella Hill at Leadville, Colo., under the management of the National Lead Co., is regarded as significant by local operators. This is the first venture of the company in the Leadville district. Present plans contemplate an extensive campaign of exploration on the lower workings of the Fortune.

Machinery is being installed on the Penfield to develop ore zones on the upper contact in the blue limestone. The output will be shipped to the company's reduction plant at Canon City for treatment.

Will Expand Godiva Operations

The Godiva mine, at Eureka, Utah, lying just east of the Plutus property of the Chief Consolidated, is being operated by the Bechtol Leasing Co.

During the summer, owing to the difficulty in securing water to run the steam plant, work has been confined to the 200 level and stopes lying above. Water has been secured, and as soon as the machinery has been overhauled, the steam plant will be started. After this work at lower levels will be started.

Australian Letter

By Our Special Correspondent for Queensland

Tin Production at Herberton Continues to Increase

Prosperity in Kangaroo Hill Field, Also—Canary Mine Particularly Good—Bunker Hill to Increase Output

Brisbane, Sept. 8—Good results concontinue to follow work on the Herberton tin field, in North Queensland, where production is increasing each month. Besides tin, which is the chief product, the field yields considerable silver and lead, as well as some copper. A notable tin mine on the field is one called the Old Bradlaugh. More than a year ago this mine was producing ore, giving a return of more than 30 per cent of tin. To provide for more economical mining, more than a year has been spent in development work, and the mine now is about to again yield crushings of equally high value, with the advantage that the tin will be recovered at a lower cost. At the same time a fresh rich shoot of very high-grade ore has been discovered at a level higher than that at which previous good returns were obtained.

The Kangaroo Hill tin field, two hundred miles or so further south, also continues to show evidence of prosperous activity. One of the mines of the Sardine group, called the Canary, has been developing particularly well recently, and the company owning it is paying dividends.

An old mine, now named the Big Brill, has been reopened and is producing ore yielding up to 70 per cent of tin concentrates.

It is reported that in the Ibus mine, on the Mount Isa silver-lead field, prior to entering the lead carbonates in the hanging-wall formation, 27 ft. of a much leached iron gossan, carrying small values, was passed through; that there were next entered bands of lead carbonates interbedded with shales; that the ore bands were then found to be growing larger and more frequent as depth was increased, and that the shaft is now (at 109 ft.) in good ore. These shales appeared to the naked eye to be valueless, but assays of three samples gave an average of 20.56 per cent of lead and 3¼ oz. of silver per ton. These results are considered to be of particular importance as indicating great possibilities of mining profitably in bulk a vast formation that was at first thought to be fit only for the mullock heap.

The Broken Hill Proprietary Co., of New South Wales, has worked most of the accumulated dumps from its lead mines at the Barrier, but during 1924 substantial quantities of slimes were produced, and both zinc concentrate and lead concentrate were obtained. The company has reopened its mine, which had been closed since 1921. As the result of six and a half months' working, it raised more than 36,000 tons of ore, and the quantity treated now is about 2,300 tons per week. It is hoped to increase this quantity to about 3,000 tons.

Toronto Letter

By Our Special Correspondent for Northern Ontario

Noranda Mines, Ltd., Will Increase Capital to $15,000,000

Large Tonnage of Gold-Copper Ore Partly Developed in Horne Property in Quebec

Toronto, Oct. 17—It is understood that the capital of the Noranda Mines, Ltd., will be increased to $15,000,000 and that a public issue will be made. The Noranda, which has been financed by a syndicate of American and Canadian mining men, owns the Horne property in northwestern Quebec. Developments to date on this property indicate that it is one of the outstanding discoveries in Canada during recent years. A considerable amount of diamond drilling has been done, and though official figures have not been given as to the tonnage indicated, it is believed that this will approximate 3,000,000 tons running an average of about $6 in gold and 5 to 6 per cent copper. Underground operations are now under way with a view to confirming the results of the drilling. The property is a considerable distance from transportation, but if underground developments are satisfactory, there is no question that either the C. P. R. or the T. & N. O. railway will be extended to the district.

Net earnings of the McIntyre mine for the first quarter of the company's fiscal year ended Sept. 30 last amounted to $428,000 before provision for plant depreciation. Gross recovery was $904,000 and costs including development were $463,000. The contract for sinking the new 4,000-ft. shaft has been given to H. A. Kee, formerly manager of the Kerr Lake Mines. An organization separate from that of the mines will be built up to take care of this work.

The Kirkland Lake branch of the Nipissing Central Ry. will soon be in operation, and it is expected that trains will be running by Nov. 9. This will represent a considerable saving to the mining companies, as heretofore all freight has had to be transported several miles by trucks or teams. The road extends as far as the Crown Reserve property, in Larder Lake, and there is a possibility that it may be further extended to the new gold fields in northwestern Quebec. For the present storage-battery cars will provide daily service.

The Lake Shore mill is now treating more than 300 tons a day, and as the grade is running about $18 a ton, the present rate of output is in excess of $1,750,000 a year. The company pays 5 per cent dividends quarterly, a total of $400,000 a year, so that the net profits will be very largely in excess of the dividend requirements. Developments underground, particularly on the 800 and 1,000 levels, are satisfactory, and substantial additions are being made to the ore reserves. The grade on the 1,000 level is similar to the upper levels.

During September, production at the Teck-Hughes mine was $71,000. This was lower than during the preceding months and was due in part to a breakdown of the compressor, which necessitated drawing lower grade ore from the surface dumps. It is understood that the management expects to concentrate its operations for the time being on the upper levels, and this will probably result in a drop in grade during the next few months, but as soon as the shaft is completed to the 1,600 level an extensive campaign of exploration will be carried on below 800 ft., where most of the highest-grade ore is found. It is understood that the management has under consideration the construction of a new mill of larger capacity.

Novel Scheme for Promoting Safety in Mines

IF A MINER at the Lucky Bill mine, in the Joplin-Miami zinc-lead district, breaks any one of the fourteen safety rules promulgated by the safety and sanitation committee of the local section of the American Zinc Institute, he is haled before a "kangaroo court," operated by the men, and fined.

The court is held every Wednesday, at noon, time being made for it by the men all going to work five minutes early every working day in the week. They are showing much enthusiasm for the court, which is run on a no-favorite basis. The ground boss himself may be arrested and fined. The "judge," "prosecuting attorney," and "sheriff" are elected at each meeting of the court.

In addition to the fines, the organization has an income created by a weekly assessment of 25c. This the men pay cheerfully, and the treasury has considerable money on hand, despite the fact that it recently financed a trip to Arizona for one of the employees at the property.

The Lucky Bill is one of the mines purchased some months ago by the Federal Mining & Smelting Co. The company reports that operation of the court has resulted in a reduced number of accidents.

Garbutt Plans to Reopen Tennessee Mine, at Chloride

The 1,200-ft. shaft of the Tennessee mine, at Chloride, Ariz., is being repaired, and it is probable that the property soon will be active again. Between the 900 and 1,100 ft. levels is said to lie an 8-ft. orebody, 250 ft. long, from which ore shipped to the Needles smelter average a 20 per cent lead and 20 per cent zinc, in addition to gold and silver. There is expectation that deeper exploration will develop similar veins.

The mine, as well as the neighboring Schuylkil, is now owned by Frank A. Garbutt. On the lower levels it is said that there is 40,000 tons of good ore, ready for stoping.

Mexico Letter

By W. L. Vail

Special Correspondent

A. S. & R. Co. Contracts to Operate Victorio Properties

Mines at San Luis Potosi—Twenty-Year Contract—Will Invest $50,000 Annually

Mexico City, Oct. 14—The Victorio Mining Co., of San Luis Potosi, Mexico, has just closed a twenty-year contract with the American Smelting & Refining Co. for the operation of its properties. The lessees agree among other conditions, to invest not less than $50,000 every four years in exploration work during the life of the contract and to pay a royalty of 15 per cent on all ore up to $20 and 25 per cent on ores which exceed $20 in values. The A. S. & R. has already considerably increased the force at the mines and contemplates active development.

The Triunfo Mining Co., of Lower California, has gone into voluntary liquidation with the intention of prorating the salvage among the stockholders. It is estimated that the latter may expect about 10c. on the dollar.

It is reported that the Peñoles interests have taken over the old Natividad mine, in Oaxaca, and have an option on the Suriano, adjoining the Campo Morado, in Guerrero. At the latter property it is preparing to construct an additional 200-ton smelter to handle the lead and copper contents of the ores. The Peñoles has also taken over some large interests in the old Tasco camp in the State of Guerrero, which appears to be coming back to life after a number of years of comparative idleness.

The Azarco Mining Co., of Chihuahua, has applied for a special concession from the State of Chihuahua for the establishment of a reduction plant at Parral. It will treat ores by flotation. The proposed mill will have a capacity of 400 tons daily, and is expected to cost approximately $250,000. The plant must be completed within eighteen months after the contract with the state authorities is signed.

Unusual activity has been displayed in the State of Durango during the last few months, and a large number of denouncements have been made, a number of them by American interests. N. H. Murphy is opening up some gold and silver prospects in the Duraznitos district and has also recently taken over the Belen group of six claims adjoining the Tehuehuto mines. A number of Americans have gone into the Inde district lately and acquired considerable property by purchase and denouncement.

In Sonora, some attention has been turned recently toward a revival of placer activity, and denouncements have been made covering a large area in the northwestern part of the state, mostly by Americans. The old Esperanza mine, in the Colorado district, has recently changed owners and name (now Marionete). The old workings are being cleaned out and new shafts sunk. The Esperanza has been an excellent producer in times past.

Birmingham Welcomes A. I. M. E.

Alabama Mining Institute and Important Operators of District Give Visitors an Interesting Time—Muscle Shoals Visited

Staff Report

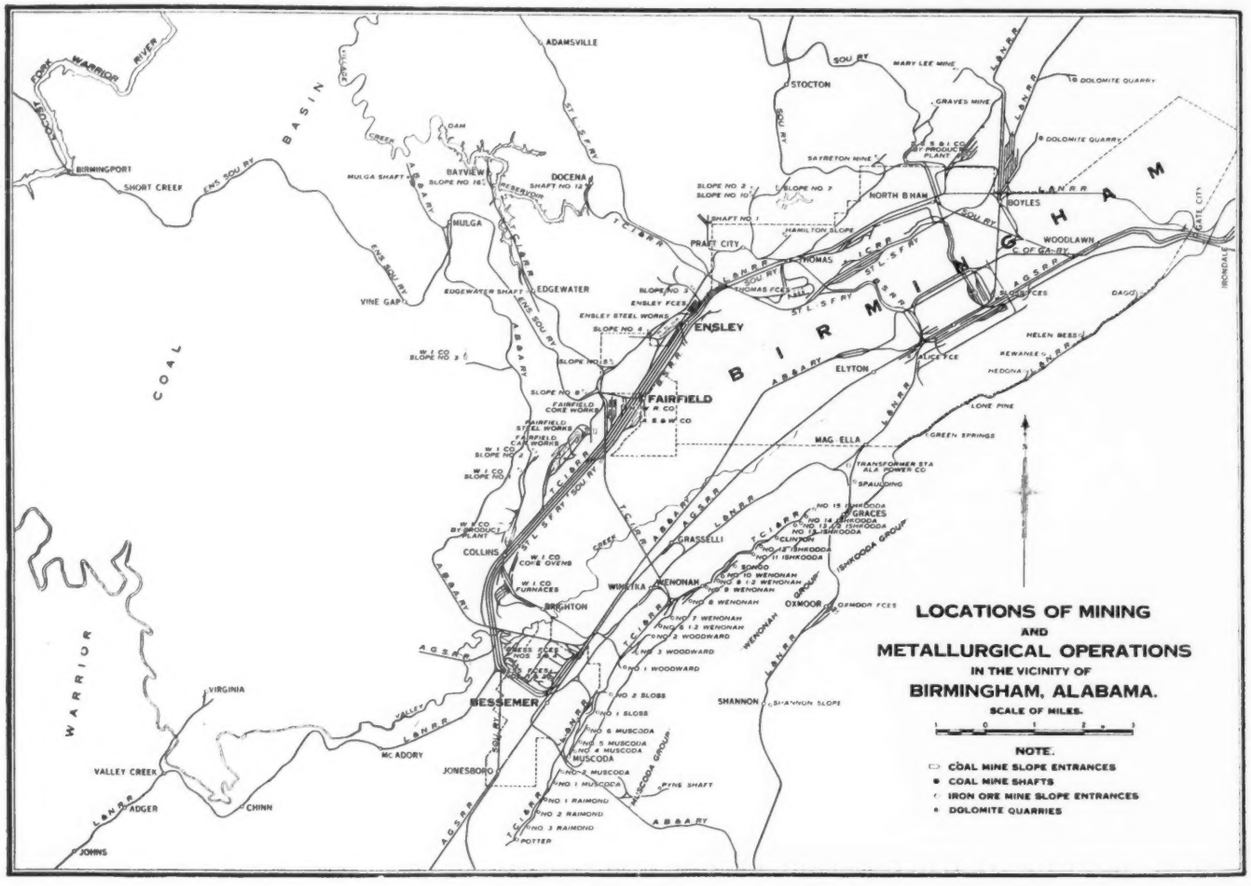
Continued from last week

"THE BIRMINGHAM DISTRICT is one of two known places in the world where coking coal, iron ore, and fluxing stone (limestone and dolomite) appear within a few miles of each other," says a guidebook that was especially prepared for the benefit of the visiting members of the American Institute of Mining and Metallurgical Engineers during the three days spent in the district from Oct. 13 to 15, in the course of the 130th annual meeting of the Institute, which concluded its ten-day trip through the mining camps of the South on Oct. 17. "The fluxing stone is exposed at many places (permitting open quarrying) in the anticlinal valley (75 miles long and 6 to 10 miles wide, embracing about 450 square miles) in which Birmingham is situated. . . . The red ore seams outcrop along the side of Red Mountain, which bounds this valley on the southeast; and the Warrior coal field lies immediately beyond the chain of hills (known as the western break of Red Mountain or the foothills of Sand Mountain), which bounds the valley on the northwest. With its favorable climatic conditions, ample supply of tranquil and efficient labor (both skilled and unskilled), proximity of raw and semi-raw material, the district has proven ideal for mining and manufacture." The visiting Institute members had an opportunity to observe all these facts for themselves.

The snap and energy visible in Birmingham business life was evidenced in the way in which the technical sessions were conducted. Promptly at the appointed time on Monday morning the opening session was called to order by George Gordon Crawford, president of the Tennessee Coal, Iron & Railroad Co., who occupied the chair. On behalf of the Alabama Mining Institute the chairman extended welcome to the delegates. Not since 1888 had the A.I.M.E. met in Birmingham, he said. He then introduced William Kelly, president of the A.I.M.E., who said that in 1908, when the Institute had come to Ducktown, it had also planned to visit Birmingham, but labor difficulties arose and the plans were changed, one reason being, the speaker remarked humorously, that otherwise it might have been thought that the members were strike breakers.

Three coal papers were on the morning's program. These were: "Coal Washing Practice in Alabama," by Henry S. Geismer, of the Keiser-Geismer Engineering Co.; "Byproduct Coking in Alabama," by Frank W. Miller, manager of the Sloss-Sheffield company's byproduct plant; and "Alabama Coal Mining Practices," by Milton H. Fies, vice-president of the De Bardeleben Coal Corporation.

More men were killed in Alabama per thousand employed than in any other state in the country, according to Mr. Fies in his paper on mining practices. One paragraph attracted considerable attention: In Alabama, as in other states, he said, the more progressive and humane operators added to their cost per ton by utilizing precautionary measures, while the less progressive operators disregarded ordinary safety standards. As a result, the progressive operators were at a disadvantage in periods of fierce competition. While he believed that the principle of "less government in business" was sound, said Mr. Fies, at the same time it had to be conceded that government supervision was necessary when human life



This map is reproduced from a book entitled "A Little Journey in the Birmingham District" supplied to those who registered for the meeting at Birmingham

was at stake. The only means by which safety standards, applicable to all producers of coal, could be fixed, he said, was through the action of the Federal Government. R. V. Norris, in discussing this point, declared himself against any federal action whatever. George S. Rice, of the U. S. Bureau of Mines, thought that uniform state regulations were desirable but that any extension of federal authority over mines not under government control was undesirable. R. Dawson Hall, of *Coal Age*, said that unequal state regulations gave operators in some states an advantage over those in others. Mr. Miller's paper on byproduct coking was presented without discussion.

Ferrous Metallurgy Has Own Session

All of the metallurgical papers on the program for the afternoon session, over which Frank H. Crockard, president of the Woodward Iron Co., presided, were not presented. That of Richard Moldenke, on "Manufacture of Cast Iron in the South," was passed by in the author's absence. This very interesting contribution included a discussion of the advantages and disadvantages of the centrifugal casting process. Later in the week, on Wednesday afternoon, the members and guests had an opportunity to see pipe made by this process, at the Tarrant City pipe works of the National Cast Iron Pipe Co., of Birmingham. The De Lavaud process, as it is known, was perfected about four years ago and was the first practical method of making cast-iron pipe in a machine. The process was worked out in Toronto by Mr. De Lavaud and the National Iron Works, Inc. Subsequently, the United States Cast Iron Pipe & Foundry Co. bought the American manufacturing rights and granted a license to the Birmingham company. The principle on which the machine is designed is that the molten iron, discharged in a small stream against the bore of a spinning mold, remains fluid until the iron deposited by subsequent revolutions has welded in. The water-cooled steel mold quickly dissipates the heat in the iron, and the pipe contracts sufficiently to permit of easy withdrawal from the mold. The quick cooling causes a chill face on the outside of the pipe, which is afterward softened by annealing. This is done by passing the pipe through specially designed gas-heated ovens, in which the temperature of the pipe is gradually increased and decreased as it progresses by rotary motion from entrance to exit. After annealing, bell cores are removed from the end, and each piece is inspected and subjected to a hydrostatic pressure of about 450 lb. per square inch. The pipes are coated when required. About three hours' time is required by the process to make the shipping product from the original pig.

Presentation of a paper entitled "Effect of Sulphur on Blast Furnace Process," by T. L. Joseph, of the Minneapolis Experiment Station of the U. S. Bureau of Mines, which was on the program, was deferred until the February meeting the Secretary of the Institute, F. F. Sharpless, announced. H. E. Mussey's paper on "Blast Furnace Practice in Alabama" was discussed briefly by C. A. Meissner, chairman of the blast furnace and coke committee of the U. S. Steel Corporation. In this paper, Mr. Mussey described the development of the blast furnaces in Alabama and briefly summarized the practice of the district. Increased production may be expected, he said, as a result of even larger furnaces than those now classified as large furnaces.

In recent years there has been a decided increase in the use of ferrophosphorus in the steel industry. An interesting paper on the program of the metallurgical session was that by Theodore Swann, of Birmingham, president of the Federal Phosphorus Co. In this short and concise paper, which was entitled "Production of Ferrophosphorus in the Electric Furnace," Mr. Swann told of events leading up to the manufacture of ferrophosphorus and gave the important details of the process of manufacture. In presenting the paper he said that his company today was making ferrophosphorus as a byproduct from the manufacture of phosphoric acid, whereas formerly the phosphoric acid was the byproduct.

A figure prominent in Birmingham circles and one that immediately attracts the attention of a visitor is that of James Bowron, chairman of the Gulf States Steel Co. Mr. Bowron's career has been identified with the development of the Birmingham district since its early days. In an informal paper at the metallurgical session, a paper that was not distributed, Mr. Bowron sketched the history of steel making in Alabama and told of the rise of the great companies that dominate the industry there and of the vicissitudes of their fortunes.

Visitors See Shannon Mine

A surprise on the program of the first day was a visit to the Shannon mine of the Gulf States Steel Co. The metallurgical session was shortened to make this possible before dark. As has been stated, the seams of red ore outcrop along Red Mountain on its western face, which looks toward Birmingham, dipping southeastward into the hill at a gentle angle that varies. The Shannon slope (or incline) is unusual in that it was started several miles to the eastward beyond the outcrop on Red Mountain and intersects the seam beneath the foot of Shades Mountain at a point about 1,900 ft. below the surface. Here the company has opened a good-sized piece of ground in which it has 19 ft. of self-fluxing ore. The visitors were lowered with all too solicitous care in a canvas-covered man car to prevent soiling the clothes—a bit of unintended humor. Free inspection of the workings near the foot of the slope was permitted under the guidance of employees. The company, which has had a difficult time in reaching its present stage of development, has now arrived at a point where it seems to have clear sailing.

In the evening in the ballroom of the Hotel Tutwiler, where the earlier sessions had been held, the third and final technical session took place, with Truman H. Aldrich, Sr., in the chair. Four papers on iron ore, geology, and mining were on the program. One of these, on the "Geology and Utilization of Tennessee Phosphate Rock," by R. W. Smith, of the Tennessee State Geological Survey, was deferred until the February meeting on account of the short time available. The three remaining papers were long ones, on the preparation of which much time and care had been expended by the authors. The first was entitled "Economic Geology of the Birmingham District, Alabama," by Dr. E. F. Burchard and Charles Butts, both of the U. S. Geological Survey, who were the authors, also, of the well-known Bulletin 400, entitled "Iron Ores, Fuels and Fluxes of the Birmingham District, Alabama," which the Geological Survey issued in 1910 and which is still regarded as the most authoritative and comprehensive work written on the district. Therefore the presentation of the new paper by Dr. Burchard was received with close attention.

The two other papers were both by Dr. Walter R. Crane, superintendent of the Southern Experiment Station of the U. S. Bureau of Mines, who makes his headquarters in Birmingham, although the station itself is at Tuscaloosa, 60 miles south. Their titles were: "Red Iron Ore Mining Methods in the Birmingham District" and "Roof Support in the Red Ore Mines of the Birmingham District." These two papers, it is understood, represent four years of work on Dr. Crane's part. In presenting them, the author did not merely repeat or summarize the contents of the paper, but used lantern slides, of which he has a great number, to teach the audience by means of photographs taken underground and in the open the different points and principles that he was endeavoring to demonstrate. Unfortunately, the time available did not suffice for the complete exposition of both subjects. However, the papers are available for those who want to read them.

This concluded the technical sessions, which were thus confined to one day of the entire meeting. Several other papers had been prepared and distributed in pamphlet form, which, however, were not on any program and for the presentation and discussion of which no opportunity was offered. One of these was entitled "Notes on the Clinton Group in Alabama," by Truman H. Aldrich, who presided at the last technical session mentioned. In this paper Mr. Aldrich set forth some data that had been obtained in drilling for the Clinton formation in areas outside of the known ore-bearing area. Possibilities of a source of red ore not seriously thought of until lately were thus demonstrated, according to Mr. Aldrich. The conservative remarks of this engineer are not to be confused with or interpreted as supporting the flamboyant statements of certain promoters with regard to an alleged enormous tonnage of iron ore in the Raccoon Mountain section of northeastern Alabama, to which the *Journal-Press* referred in an editorial in its issue of July 5, 1924.

Other papers for which no opportunity was offered for presentation included two on the work at Mascot—namely: "Milling Practice of American Zinc Co. of Tennessee at Mascot," by Robert Ammon, mill superintendent for the company; and "Mining Methods of

American Zinc Co. of Tennessee at Mascot," by H. A. Coy, mine superintendent there. There were likewise two papers on the Ducktown district, one entitled "Ducktown, Tennessee, Copper District," by Wilbur A. Nelson, state geologist; and one "Smelting Copper Concentrates in a Converter," by F. J. Longworth, general superintendent for the Tennessee Copper Co. at Copperhill. Another paper that was omitted was one entitled "Manufacture of Ferrophorphorus at Rockdale, Tennessee," by James A. Barr, of Mount Pleasant, Tenn. Edward O'Toole, general superintendent of the United States Coal & Coke Co., of Gary, W. Va., had also written an interesting paper under the title "Pocahontas Coal Field, and Operating Methods of the United States Coal & Coke Co."

Unusual opportunities were afforded the members on Tuesday and Wednesday to visit the ore and coal mine plants, the furnaces and the manufacturing plants of the district. In the hands of each person at the start was put a copy of the "guide" book entitled "A Little Journey in the Birmingham District," which had been especially prepared for the occasion. To this was appended an illustrated book entitled "Iron and Steel Making Methods in Alabama," prepared by the Tennessee Coal, Iron & Railroad Co. A special train was provided, and the party was divided into groups, each with its own guide. Each of the two trips started promptly at 8.30 a.m.

Lack of space forbids any attempt to do more than mention the plants visited. In their order those at which stops were made on Tuesday were the Ishkooda No. 13 ore mine of the Tennessee company; No. 1 ore mine of the Woodward Iron Co.; Muscoda No. 6 ore mine of the Tennessee company; and the latter company's coal mine at Bayview. Here a barbecue lunch was served, after which the coal washing plant was visited. Thence to the same company's Edgewater coal mine, the largest in Alabama, where the washing plant, also the largest in the state, was inspected. Leaving here, the party proceeded to the Fairfield coke works of the Tennessee company and from there to the Fairfield wire mill of the American Steel & Wire Co. At both of these extensive plants the route to be followed by the party was marked by a white line on the floor. The only rules that the visitors were asked to observe were to keep with their guides and to follow the chalk line. Numerous other plants and points of interest were observed from the train en route. At 5.30 p.m. the party returned to Birmingham.

That evening the directors of the Institute met at dinner in the Tutwiler. In another room the Industrial Relations Committee of the Institute also met to dine, with Frank H. Crockard, president of the Woodward Iron Co., as speaker of the occasion. Mr. Crockard discussed the subject of relations between employer and employee, beginning with the dark days of the panic of 1907, and sketched briefly the history of events leading up to the present. He laid stress on the prosperity to be noted in the district, saying that since 1908, the last year in which any wage negotiations were conducted with the United Mine Workers of America, there had been sixteen voluntary wage increases and only three decreases. The three reductions were all in 1921 and were due to the depressed general conditions that affected the entire nation. Afterward, those present proceeded to the Phillips High School Auditorium, where the colored choir of the Sixteenth Street Baptish Church entertained the members. Motion pictures bearing on minerals and mining, power, and the cotton industry were shown by courtesy of the Alabama Power Co.

The blast furnaces, open-hearth

J. V. W. Reynders

plants, converters, and the rail mill at Ensley, and the car works and steel mills at Fairfield, all being plants of the Tennessee Coal, Iron & Railroad Co., were visited on Wednesday by the members. It would be hard to state which of these afforded the most interesting sights—certainly the converters were the most spectacular. Luncheon was served at the plant of the Pheonix Portland Cement Co. at South Birmingham. Afterward the limestone quarry and the cement plant were visited. Ground was broken for this plant on Sept. 25, 1922, and the first barrel of cement was made on April 28, 1923, a record said to be not equaled in cement mill construction. After leaving the cement plant the party was taken to the Tarrant City Pipe Works, where the casting of pipe by the centrifugal process was witnessed, as has already been described. The members then returned to Birmingham.

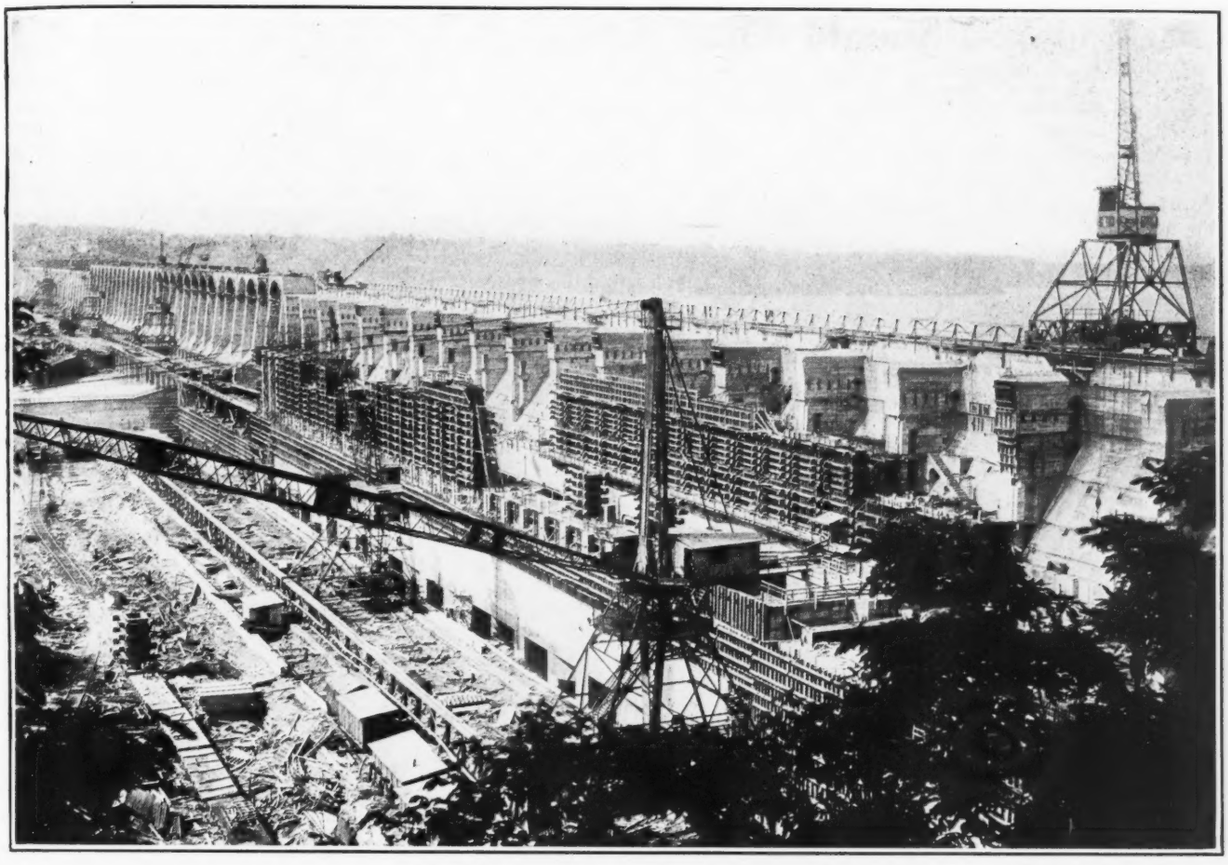
Visit Concludes with Banquet

Of the three banquets given during the ten-day meeting, the one with which the stay in Birmingham concluded was the least formal and the most lively. The place selected for it was the Birmingham Country Club. Only three speakers were on the program. These were: Mr. Kelly, president the Institute; John McLeish, head of the Mines Branch of Dominion Department of Mines at Ottawa, who came with G. C. Bateman, of Toronto, as a delegate of the Canadian Institute of Mining and Metallurgy; and John V. W. Reynders, of New York, well-known in iron and steel circles. Mr. Reynders, remarking that he had been told that he might talk about ten minutes, said that he might sum up the whole subject by saying that ten minutes in Birmingham was worth a lifetime in Pittsburgh—even if the government had succeeded in relieving Pittsburgh of some of its baser aspects and transferred them to other steel centers. "You have given up your normal pursuits for three days," said Mr. Reynders to the local iron and steel men present, "and yet in that period we could do no more than form a general idea of Birmingham. . . . You have demonstrated here not only that your raw materials are susceptible of economic reduction, but that steel of excellent quality can be made by Democrats. In Pennsylvania that has never been attempted. . . .

"The American Institute of Mining and Metallurgical Engineers is well past its fiftieth year. . . . The wealth of this great district, the wonders of which we have just had the privilege of witnessing, was unscratched when our Institute was founded. A man of vision may be defined as a visionary who has guessed right. There were many visionaries here, and many whose only fault was that they saw too far and too soon. To the mining engineer was given the task to see below the surface, to separate the chaff of the promoter from the wheat of the man of vision. It was a burden of great responsibility to designate just where and how these imperfectly known deposits must be attacked to insure commercial success. But no sooner had the geological charts been outlined in general terms than new and theretofore unsolved metallurgical problems had to be met and worked out. It was a fortuitous circumstance that the development of the many new processes and methods of manufacture was unhampered by lack of financial resources after the entry of the U. S. Steel Corporation into the district. Unquestionably, progress was hastened by at least a decade, not only due to the amplitude of the means available but also to the wide powers of discretion of those who were given the directing authority. The example set by the same corporation in the development and advancement of metallurgical practice has been and will be of inestimable benefit to the industry as a whole.

"It must be a source of gratification to those who have had the direction of the industries in the Birmingham district to contemplate the human results of their efforts. In their concern for the welfare of their employees they are engaged in an undertaking of the utmost public importance and one that exemplifies engineering in its broadest aspect. And let me remind you of the unique position which the mining and metallurgical engineer occupies in relation to these broader aspects of the profession. He has contact on the one hand with the artisan and on the other with the financier. His sympathies, if properly balanced, embrace both extremes. His field of operation is not circumscribed by national boundaries, but extends over continents. In environment and with such broadening contacts it is impossible for the engineer to live without gathering month by month and year by year an intensified devotion to the cause of human progress.

"And yet it may be frankly admitted that the profession of engineering has not been conspicuous (except in a few prominent instances) in the solution of our social problems. Perhaps the rea-



Wilson Dam (No. 2 Dam) at Muscle Shoals on Tennessee River, northeastern Alabama, from the south bank

son may be found in the engrossing character of the day-to-day duties imposed upon engineers; perhaps the reason lies in too great a tendency toward specialization in engineering education. . . .

"Should the day ever arrive when a general overhaul becomes necessary, let us hope that the engineer will have prepared himself in advance with particular knowledge and accurate appreciation of the elements which go to make up the intricate machinery of a civilization in which the component of human nature may be the same as it has been throughout history, but in which appear new factors raised, maybe, to the third power, representing unprecedented growth of population, enormously increased consumption of raw material, and, last but not least, the development of intercommunication that gives to world movements dynamic potentialities for which history has no precedents."

Wilson Dam and Nitrate Plants Inspected

Leaving Birmingham early Thursday morning, the special train carrying the Institute party arrived at Sheffield a little after luncheon and was taken to the south side of Wilson Dam in an open observation train by the United States Engineers. About two hours were spent in exploring and inspecting the unfinished power house, with its huge turbines, and the dam itself, inside and out, both from the top and from the river level, as well as the locks. The accompanying photograph shows the progress of construction up to the time of the visit, the advance made since last May, when a member of the *Journal-Press* staff visited the spot, being remarkable. It is predicted by the engineers that by Jan. 1, 1925, the concrete work will be completed.

It is said by some who base their statements on the reports of Army engineers, that figures which have been published regarding the power capacity of Muscle Shoals have given the public an exaggerated idea of the possible output at the Wilson Dam. The development has been rated at 600,000 hp., and it is proposed to install ultimately generating machinery to that amount. Flow data of the Tennessee River at Muscle Shoals show that the primary power (or power that can be delivered continuously throughout the year) has not exceeded 80,000 hp. in many years. In the highest recorded year of flow, the primary power did not exceed about 200,000 hp., so that to make even 200,000 hp. available as continuous primary power an additional steam plant of about 120,000 hp. would be necessary. It is held, therefore, that the steam plant built by the government in connection with Nitrate Plant No. 2 should be kept and completed as an adjunct to Wilson Dam.

The secondary power or that which could be utilized from the development over and above the 200,000 primary horsepower combination of steam and water power would be irregular in character, it is declared, depending on stream flow, and would not be applicable for the use of industries which must operate continuously throughout the year unless still further steam plant capacity be provided. The flow data referred to are said to show that an output of 600,000 hp., as proposed for the development, would be highly intermittent and that in an average year the delivery of such an amount could be expected only for about one-fourth of the time.

From the dam the party was taken to U. S. Nitrate Plant No. 1, which was built as an experimental plant to operate on the synthetic ammonia process, with a rated capacity of 8,000 tons of fixed nitrogen annually, and then to U. S. Nitrate Plant No. 2, based upon the well-known cyanamide process, with a rated annual capacity of 40,000 tons of fixed nitrogen. It is said, however, that the progress of scientific work since the completion of Plant No. 2 has rendered the cyanamide process—the only one upon which it can operate without uneconomical rebuilding—commercially obsolete, for making nitrogenous fertilizer. The trend, it is said, is steadily away from larger power requirements and toward more strictly chemical processes. Electric power, required in large blocks for the cyanamide process, is a factor in the synthetic ammonia process only when it can be had cheaply enough to be used for the electrolytic production of hydrogen. And it is added that an adequate cheap supply of the products of the coal and coke industry is a more important factor in locating a modern synthetic ammonia plant than is hydro-electric power excepting at a cost far below a figure possible at Muscle Shoals.

The party after leaving Sheffield returned to Washington and disbanded.

Men You Should Know About

Robert E. Tally is visiting in the Butte district.

Newton Booth Knox, consulting geologist, of London, is in Italy.

Murray Innes recently left San Francisco en route to Terlingua, Tex.

E. T. McCarthy is now in Arizona, examining mines near Phoenix.

W. C. Browning, general manager of the Magma Copper Co., is in the East.

Frank D. Pagliuchi has returned to California after an extended trip to Venezuela.

W. C. Alden has completed his field work in Wyoming for the U. S. Geological Survey.

John G. Kirchen, general manager of the Tonopah Extension mine, has gone to California on business.

R. H. Channing, Jr., general manager for the United Comstock Mines Co., has been in Virginia City and Reno.

W. A. Barnes, of San Francisco, has been in Eureka, Nev., inspecting operations in the Eureka Holly mine.

J. J. Calderwood is on his way to Central America, and **Stanley C. Bullock** is proceeding to the Federal Malay States.

Charles Bracklin, William R. Maloney, and **James O. Carlisle** have taken an option on the Oxford mine, in Sierra County, Calif.

H. C. Carlisle, western engineer for the Tonopah Mining Co., has been in Hamilton, Nev., from his San Francisco headquarters.

A. H. Lawry, general manager for the Goldfield Consolidated Mines Co., in Goldfield, has returned to Goldfield from San Francisco.

D. G. Kerr, of Pittsburgh, Pa., vice-president of the U. S. Steel Corporation, has returned from a month's visit to northern Michigan.

Dr. George Otis Smith, director of the U. S. Geological Survey, addressed the International Petroleum Congress, held recently at Tulsa, Okla.

George P. MacKenzie, gold commissioner of the Yukon, is on his way to Ottawa to confer with the government on the affairs of the territory.

W. D. Loose, for many years a well-known operator in the Tintic district of Utah, has gone to Los Angeles, Calif., and will make his home in that city.

Thomas Creighton, who represents the Mining Corporation of Canada in The Pas mining area of Manitoba, is investigating a property at Cold Lake.

Alfred Wandke, formerly on the operating staff of the Moctezuma Copper Co., is now manager of the Guanajuato Consolidated Mining & Milling Co., at Guanajuato, Mexico.

Augustus Locke, of San Francisco, under whose supervision an extended geological survey of the Copper Queen mines is being made, was a recent visitor to the Bisbee district.

Thomas Fortune Ryan 3d was married in El Paso, Tex., on Sept. 30, to Miss Alberta Eaton, daughter of **A. L. Eaton,** former manager of El Potosi Mining Co., Chihuahua, Mexico.

Carl Erickson, assayer of the Noranda Mines, in the Rouyn gold field, was severely burned in a fire that recently nearly destroyed the assay office with its equipment and supplies.

Dr. L. D. Ricketts addressed the Southern California Section of the A. I. M. E. at the California Country Club, Los Angeles, on the evening of Oct. 14, the subject being "Recollections of an Arizona Miner."

D. C. Jackling

D. C. Jackling, president of the Utah Copper Co., has been in Salt Lake City, on a trip of inspection to the Utah Copper property and is now in New York.

Freeman Bull has returned to Joplin after two years spent in the Malay Peninsula, working for the Yukon Gold Co., one of the Guggenheim properties. The company has installed Cooley jigs, the type used in the Joplin field, and is getting fine results with them, according to Mr. Bull.

Major W. J. Oakman, of New York, and **Colonel A. T. Watson,** a British engineer, who have been engaged during the season in drilling for gold on the Upper Peace River, have returned to Edmonton, Alta. They say that though there are surface indications at some points, exhaustive tests have failed to discover gold in paying quantities.

Foster S. Naething, for the last three years manager for the Kansas Exploration Co., a subsidiary of the St. Joseph Lead Co., has resigned, his resignation to take effect Nov. 1. It is stated that Mr. Naething has found it necessary to devote more of his time to his personal holdings, some of which are in Joplin and some in Minnesota and Arizona. During the time of his managership the Kansas Exploration Co. has spent more than $1,000,000 in exploration and drilling in this field.

G. F. Loughlin, chief of the U. S. Geological Survey, in accordance with an agreement with the Survey and the Colorado Metal Mining Fund, arrived in Colorado on Oct. 20, for a two months' visit to make a survey of the deeper workings in Cripple Creek and Leadville mining districts. The investigation in the Cripple Creek district will be for the purpose of making an extensive study of the deeper levels; the Leadville survey is for the purpose of revising a report on that district, the manuscript of which has just been completed but which was based upon investigations conducted several years ago. The chief work in Colorado is to bring up to date various government reports on these districts, that of Cripple Creek dating back to 1906.

Sir T. W. Edgeworth David, a notable Australian scientist, recently had conferred upon him by the Geological Society of America the honor of correspondent of that institution. Professor David was born in 1858, and was a scholar of New College, Oxford. He is now, and has been for a number of years, professor of geology and of physical geography in the University of Sydney, New South Wales, Australia, as well as the William Hilton Hovell lecturer in those two sciences. He is likewise a fellow of the senate of the Sydney University. Formerly, Professor David was a member of the geological survey of New South Wales. While in that position he practically discovered, and also surveyed, the magnificient coal measures of Maitland, now the second city in that state, and by firm action on his part saved immense coal deposits from being alienated from the Crown. He is the author of a work on the Maitland coal fields, and a prolific writer and lecturer upon his special subjects. From 1905 till 1907 he was president of the Australian Association for the Advancement of Science; in 1906 he represented Australia at the geological conference at Mexico, and conducted a special investigation into the effects of the San Francisco earthquake. He also accompanied the national exploring expedition to the Antartic under Captain Shackelton. The great honor conferred by the leading geological society of America was bestowed upon Professor David in common with five other world-famous geologists—namely, **Dr. J. J. Sederholm,** Director of the Geological Survey of Finland, for eminent services in the cause of general geology; **Dr. F. A. A. Lacroix,** the French petrologist; **Dr. A. Smith Woodward,** an English paleontologist; **Dr. Gustaf A. F. Molengraaf,** stratigraphical and structural geologist, University of Delft, Holland; and **Dr. Benjiro Koto,** the doyen of Japanese geology, of Tokio Imperial University.

Obituary

George Walker, discoverer of the richest gold reef in South Africa, died recently in Johannesburg. Walker came to Africa in 1885 and made his strike the next year while building a house in Langlaate. A rush followed, ending in the tracing of the reef and the formation of the great mining companies.

Recent Technical Publications

Reviews, Abstracts, and References

An English Work on Lime and Magnesia

Lime and Magnesia. By N. V. S. Knibbs. Published by Ernest Benn, Ltd., No. 8 Bouverie St., London, E. C. 4. Price, 30s.

Lime and magnesia are numbered among the oldest known mineral products, and yet published information relating to them is scattered and incomplete. Descriptions of plants for their production, and of the mines and quarries connected therewith, have been more widely published during recent years, but other branches have received meager treatment. Therefore a book of more than 300 pages, mainly on the chemistry of lime and magnesia, is welcome.

The volume is divided into three parts —chemistry, manufacture, and uses. The first part is particularly valuable, as it consists of a thorough compilation of data on the chemistry and physics of the calcination and hydration of lime and magnesia, and the physical and chemical properties of the various calcium and magnesium compounds.

There is a strong movement at present in the lime industry toward better technical control of the burning process, the attainment of higher fuel efficiency, and maximum perfection in finished products. Most of the magnesium compounds are of more recent commercial importance, and their technique is less fully developed than that of lime. Fundamental data on the physics and chemistry of lime and magnesia are essential for the proper solution of such problems, and thus the book should find a place in the laboratory of every research technologist in these important fields.

Part 2 is brief and incomplete in its discussion of the winning and preparation of the raw materials, but this is to be expected in a work which covers chemical technology rather than mining engineering problems. The arts of burning and hydration are covered in more detail. Though the book is published in England it applies to American practice fairly well, but more attention is given to pot and mixed feed kilns than is justified by United States practice.

Part 3 describes the many and varied uses of lime and magnesia, and emphasizes their industrial importance in every community. An admirable feature for the student who desires to pursue detailed study is a bibliography at the end of each chapter. An appendix contains tables of physical and chemical properties. The book is illustrated.

OLIVER BOWLES.

Canadian Mining—The annual report of the mineral production of Canada for 1922 (pp. 228) is now available, price 50c., from the Dominion Bureau of Statistics, Ottawa, Canada.

New South Wales—The annual report of the Department of Mines, for 1923, pp. 106, is now available for 5s. 6d. from Alfred James Kent, Government Printer, Sydney, New South Wales.

Patents

Petroleum Drilling — No. 1,507,720. Sept. 9, 1924. Edward Timbs, Torrance, Calif. A combination rotary and cable tool drilling rig.

No. 1,507,972. Sept. 9, 1924. Leonard Loop, Tulsa, Okla. An oil-pump attachment.

No. 1,507,983. Sept. 9, 1924. H. M. Anderson, San Antonio, Texas. An expansible plug for oil wells.

No. 1,507,989. Sept. 9, 1824. H. H. Defenbaugh, Copan, Okla. A sand pump.

No. 1,507,986. Sept. 9, 1924. W. T. Cavender, Sabinal, Texas. A rotary well-drilling machine.

No. 1,509,564. Sept. 23, 1924. H. L. McDuffee, Gilroy, Calif. A steam oil-well auger.

No. 1,509,565. Sept. 23, 1924. E. V. Oswald, Lost Hills, Calif. A fishing tool.

No. 1,508,417. Sept. 16, 1924. J. M. Spitler, Houston, Texas. A pipe-recovering device.

No. 1,508,526. Sept. 16, 1924. B. E. Parrish, Honeygrove, Texas, assignor of one-half to D. W. Maurer, Dallas, Texas. A plug for oil wells.

No. 1,508,586. Sept. 16, 1924. R. C. Baker, Coalinga, Calif., assignor to Baker Casing Shoe Co., Los Angeles. A floating plug for well casings.

No. 1,508,590. Sept. 16, 1924. Burwell Boykin, Jr., Beaumont, Texas. A gripping device for rotaries.

No. 1,508,755. Sept. 16, 1924. F. I. Alexander, Los Angeles, assignor to the Ford Alexander Corporation, Los Angeles. A device for torpedoing oil wells.

No. 1,508,845. Sept. 16, 1924. W. D. Giles, Leesville, La. A coupling for sucker rods.

No. 1,508,846. Sept. 16, 1924. W. D. Giles, Leesville, La. An attachment for walking beams.

No. 1,508,882. Sept. 16, 1924. C. C. Hosmer, Huntington Beach, and C. H. Wines, Whittier, Calif. A rotary-drill pipe slip.

Crushers—No. 1,507,661. Sept. 9, 1924. C. G. Buchanan, East Orange, N. J. A reversible wearing plate for jaw crushers, composed of material adapted to flow under pressure.

No. 1,507,970. Sept. 9, 1924. A. A. Lazier, Buffalo, N. Y. Design of a gyratory crusher.

No. 1,509,002. Sept. 16, 1924. F. J. Straub, New Kensington, Pa. Design of crushing rolls.

Flotation Process — No. 1,508,478. Sept. 16, 1924. W. A. Scott, Chicago, assignor to Minerals Separation North American Corporation, New York City. Ore pulp is subjected to a mixture of non-frothing gas and a gaseous frothing agent.

Mineral Washer—No. 1,505,024. Aug. 12, 1924. R. A. Henry, Liege, Belgium. An apparatus for washing and separating minerals.

Cyanide Process—No. 1,509,156. Sept. 23, 1924. A. H. Lawry, Goldfield, Nev. The precious metals in solutions containing but little free cyanide are precipitated by the addition of activated carbon to the weak solution. The precipitate is subsequently filtered.

Concentrators—No. 1,509,266. Sept. 23, 1924. Charles Spearman, Westmount, Quebec, Canada. Ground ore is treated to produce segregation and agglomeration of the desired minerals, which are then removed after spreading the slightly moistened ore pulp into the form of a long freely flowing sheet.

No. 1,509,681. Sept. 23, 1924. W. E. Mendenhall, Moab, Utah, assignor to the Union Metals Extraction Co., Lake City, Colo. A box, suspended so that longitudinal oscillation is possible, equipped with trays over which the ore pulp passes.

No. 1,509,914. Sept. 30, 1924. A. H. Stebbins, Los Angeles. A pneumatic concentrator, equipped with a revolving disk and fan blades, to separate the heavy from the light portions of dry ground material. In the apparatus covered by patent No. 1,509,915, issued to the same applicant, a vertical shaft is used in which a whirling action is maintained.

Classifiers—No. 1,509,391. Sept. 23, 1924. A. L. Blomfield, Colorado Springs, Colo., assignor to The Dorr Co., New York City. An improvement in the design of the Dorr classifier, including an indicating device to show variations in the resistance to the movement of the oversize handled by the rakes.

No. 1,509,909. Sept. 30, 1924. A. H. Stebbins, Los Angeles. A pneumatic classifier by which the lighter material in a dry pulp is removed by air currents caused by suction.

No. 1,511,643. Oct. 14, 1924. L. C. Trent, Washington, D. C. A new form of hydraulic classifier in which water is circulated upward through a receptacle in the center of which ore pulp is fed.

Extracting Molybdenum—No. 1,508,629. Sept. 16, 1924. G. D. Van Arsdale, R. T. Sill, and H. A. Sill, Los Angeles. Molybdenum ores or concentrates are roasted to convert the sulphides to oxides, the calcine treated with dilute sulphuric acid to remove impurities, and the residue treated to form an acid solution of sodium molybdate. This is warmed and electrolyzed to precipitate molybdenum compounds at the cathode and to regenerate the depleted electrolyte for re-use as a solvent. The deposit on the cathode is dried, dehydrated, and removed.

Sulphating Process — No. 1,508,561. Sept. 16, 1924. G. N. Libby, Berkeley, Calif. A process of sulphating metallic compounds in ores, consisting in moistening a sulphide ore with a nitrate solution and passing the ore through a heated zone, whereby the metallic compounds are sulphated and oxides of nitrogen liberated.

Sulphur Extraction—No. 1,508,355. Sept. 9, 1924. W. P. Thornton, Chicago Hot water is mixed with sulphur-containing ore, the melted sulphur and water removed from the gangue and filtered, and the sulphur recovered.

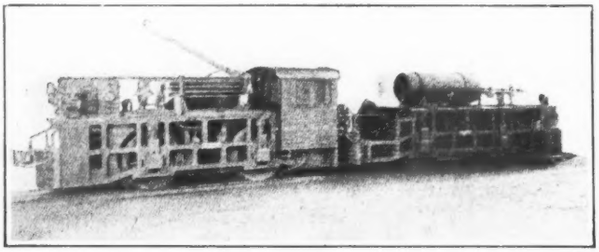
New Machinery and Inventions

An Unusual Electric Mine Locomotive

By Edwin Bjornson
Westinghouse Electric & Manufacturing Co.

A TANDEM unit locomotive with a number of features not common to the usual mine or industrial locomotive has been built for the Alaska Juneau Gold Mining Co. The brakes, sanders, inclosed ventilated motors, controller, couplers, and general arrangement of the equipment are all somewhat out of the ordinary for a mine locomotive. To get the necessary traction on the 30-in. gage, two nine-ton units were necessary.

This locomotive is of the trolley type, with the operator's cab on the primary unit. Straight and automatic air brakes are supplied and also an air-operated rail sander. The brakes are for handling the locomotive either in tandem or when the primary unit is used alone. In case of a break in the train, or between halves of the locomotive, the automatic feature takes care of the emergency and causes the brakes to be applied. The customary hand brakes are also furnished.



Alaska Juneau's new tandem unit locomotive

The primary and secondary units are each equipped with two driving motors. The locomotive is intended, however, for permanent tandem operation, and in case the halves are uncoupled, the secondary unit becomes inoperative, as all the control apparatus is installed in the cab of the primary unit. The controller is made up especially for controlling four motors. The primary locomotive is equipped with a controller suitable for use with four motors. The driving motors are of the totally inclosed, forced ventilated type, and one blower is installed for each pair of motors. In this way, the motors are well protected from snow and dirt. Standard M. C. B. couplers are used, although they are placed only 20¼ in. above the rail to accommodate the mine cars.

The drawbar pull that can be obtained is 9,000 lb. and the speed is 6 miles per hour. A drawbar pull of 10,800 lb. can be obtained at starting by using sand on clean dry rails.

The specifications are as follows: Line voltage, 500 d.c.; gage of track, 30 in.; motors, 4-31 hp.; weight per unit, 9 tons; height to top of cab, 70 in.; width, 60 in.; length (excluding couplers) two units, 29 ft.; wheels—steel tired with cast steel centers, 33 in. diameter; individual wheel base, 64 in.

The height was kept down to 70 in. on account of tipple clearance, and likewise the width was fixed at 60 in. on account of tunnel clearances. Three headlights are furnished for night use and in the mine. A lightning arrestor gives outdoor protection.

The cab is well lighted and tightly constructed to give protection from the inclement Alaska weather. There is also room for a trip rider on the auxiliary half of the locomotive. The perforated plates at the extreme ends of the locomotive are designed to serve as shields for the banks of resistance grids.

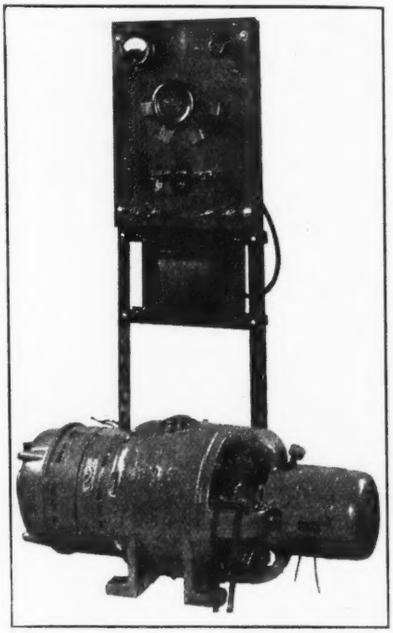
The locomotive is a duplicate of two tandem Baldwin-Westinghouse locomotives previously sold to this company. These two original locomotives have given good service, and the new one is expected by the company to give even better service, because the new type helical gearing with a higher ratio has been used. Though this reduces the speed slightly, the additional drawback pull obtained is more valuable than the slight additional speed.

A Welder for Cast-Iron Work

A 120-cycle welding generator suitable for any power installation has recently been introduced by the Allan Manufacturing & Welding Co., Inc., of Buffalo, N. Y. This firm claims to have found that alternating current gave far better results on cast and malleable iron and as good results on steel and iron as the direct-current welding sets.

The new generator is separately excited, having eight poles for 1,800 r.p.m. and ten poles for 1,500 r.p.m.; its frame is of cast steel with laminated pole pieces. Each pole piece is provided with only one coil, and all coils on pole pieces are connected in series, making a simple construction. The armature is built up on a large diameter shaft and is carried on two ball bearings, and an extension of the shaft carries the exciter armature, the frame of which is cast integral with one end bell. Where the power supply is direct current, the exciter is eliminated.

The generator can be driven by either belt, a.-c. or d.-c. motors, or by gasoline engine, and is built in any desired capacity, the most popular size being a 4-kw. set and having a range of from 50 to 200 amperes continuous output, with an unlimited number of stops between the given limits. The same flexibility applies to the larger sets. The chief trouble with the direct-current generator is in the commutator and the difficulty in replacing burned-out armature coils; these two sources of difficulty are said to be entirely eliminated in the new generator, as two slip rings replace the commutator and either eight or ten armature coils replace the many coils in a direct-current welding generator armature. In addition to the two above-mentioned advantages, there are no complicated windings or connections of field coils.



An alternating current welding generator

With the new generator, great ease of operation is obtained, the arc is easy to start and maintain and is designed for smooth and rapid deposition of metal with necessary penetration. The generator is well built and capable of delivering twenty-four hours' service, day after day, at its maximum rated capacity. It has embodied therein the L.C. or "semi-arc" feature for use in welding of light cast-iron sections.

The main object in placing this generator on the market is to preserve the many advantages of the ac arc and overcome the objections experienced in localities where the power companies' lines are somewhat loaded, owing to lower power factor and larger installations of transformer welders compared with the motor generator set.

Trade Catalogs

Crushers—The new bulletin No. 110 issued by the C. G. Buchanan Co., Inc., 90 West St., New York, describes the company's Type C all-steel preliminary breakers. Details of construction are illustrated with numerous photographs and drawings. Approximate weights, capacities, speeds, and other factors, for standard sizes are given in a table. The bulletin also describes the Type B all-steel jaw crusher and the company's line of crushing rolls.

The Market Report

Daily Prices of Metals

Oct.	Copper, N. Y. net refinery	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
16	12.80@13.00	49.25	49.75	8 05	7.85	6.275@6.30
17	12.875@13.00	49.375	49.875	8.05	7.90	6.30@6.35
18	12 875@13.00	49.75	50.25	8.05	7.90	6.325@6.35
20	12.875@13.00	50.50	51.00	8.25	8.00@8.05	6.35@6.375
21	12.95@13.00	50.50	51.00	8.35	8.00@8.35	6.375
22	13.00	51.125	51.625	8.40	8.00@8.35	6.40
Av.	12.948	50.083	50.583	8.192	8 004	6.348

*These prices correspond to the following quotations for copper delivered: Oct. 16th, 13.05@13.25c.; 17th to 20th inc., 13.125@13.25c.; 21st, 13.20@13.25c.; 22d, 13.25c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

The quotations are arrived at by a committee consisting of the market editors of *Engineering and Mining Journal-Press* and a special representative of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce.

London

Oct.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
16	62 3/8	63 1/8	66 1/2	243	245 3/4	35 3/8	33 3/4	33 1/8	33
17	62 1/2	63 5/8	66 1/2	245 1/2	247 3/4	35 1/2	34	33 5/16	33 1/8
20	62 7/8	63 7/8	66 3/8	251 1/4	253	36 1/8	34 7/8	33 3/8	33 5/16
21	62 3/4	63 3/4	66 1/2	250 1/2	252 1/4	36 7/8	34 15/16	33 11/16	33 1/2
22	62 3/4	63 3/4	66 3/8	253 1/2	255	36 7/8	35	33 3/4	33 5/8

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Oct.	Sterling Exchange "Checks"	Silver		Gold London	Oct.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
16	4.48 1/2	71 3/4	35 11/16	92s 4d	20	4.48 1/2	71 1/4	35 5/8	92s 4d
17	4.48 1/2	71 3/8	35 5/8	92s 4d	21	4 49 1/4	71	35 7/16	92s 4d
18	4.48 1/2	71 1/8	35 7/16	. . .	22	4.50	70 3/4	35 5/16	92s 1d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-quarter of a cent premium.

Metal Prices Continue Advance Under Foreign Influence

New York, Oct. 22, 1924—All of the major non-ferrous metals with the exception of silver have registered further advances in price during the last week. The chief reason for this has been a good demand in Europe, with corresponding advances in the London metal market. Lead and zinc have been in exceptionally good demand in the New York market, with copper firm in price but comparatively inactive. Silver seems to be having a slight reaction from the recent rapid rise, but there is nothing fundamentally weak in the outlook for this metal.

All Copper Sellers at 13¼

The demand for copper was reasonably good on Thursday, Friday, and Saturday; at least, sellers had no trouble in getting rid of practically all they had to offer at 13⅛c. delivered Down East and 13¼c. further west. On Thursday some spot copper was disposed of close to 13c. delivered. In the last three days inquiries have been few, but sellers are now firm in their quotations of 13¼c. delivered. Despite the fact that in the last two days very little has been sold at this level, foreign business has been sufficiently good to make most of the producers independent of any temporary lull in the domestic market.

The principal Continental countries have all been in the market for copper during the week, the price paid varying from 13.25 to 13.40c., c.i.f. Inasmuch as producers can net 13c. or better f.a.s. for their copper, they are not anxious to sell for less than 13c. f.o.b. refinery for domestic business.

Wire and brass mills have been the chief buyers during the week. Most of their demands have been for deliveries from November through January.

Holders of Lead Get Fancy Prices

The official contract price for lead established by the American Smelting & Refining Co. was advanced from 8 to 8.25c. per lb. on Monday, Oct. 20.

The present situation in the lead market is similar to that of some months ago, with the principal producers selling in limited quantities to their regular customers at considerably lower prices than are being obtained by so-called outside interests. The lead market was firmly established at the 8c. New York level for many weeks, but beginning with Oct. 14 higher prices began to be something more than nominal quotations. For a few days, consumers did not seem to worry, but now that they see that a very real upward movement is taking place, producers are swamped with orders. It is probable that some consumers overstayed their market, thinking that the price would go down rather than up and allowing themselves to be somewhat shorter of supplies than is normally their custom. Others are of course provided with all the lead they need for some weeks to come, but are anxious to lay in what additional stocks they can if any material advance in price is to occur. The strength in London, where lead prices have advanced almost daily, has of course been a leading factor in the upward trend here.

Speculative buying in the New York market is not usually a serious factor, but it is said that more or less of this has been going on recently and that interests which formerly paid little attention to the lead market are involved.

Prices in New York as high as 8.50 and 8.55c. have been secured for substantial tonnages of lead in the last two days, and in St. Louis 8.35c. has been done, although some producers are supplying limited tonnages to regular customers at 8c. Their sales have been so large in the last week or two that they have little to offer. Corroding grades seem particularly scarce.

Zinc Firm at 6.40c. Today

For some weeks, the zinc market has been largely set by the prices obtained on export business, so that when London cables showed a daily advance, as they have done during the last week,

prices here naturally rose. Galvanizers have evidently felt that they should not postpone buying any longer, for the volume of domestic sales to these consumers has been greater than for some time. Some Brass Special has been sold, but most of the demand has been for the ordinary Prime Western. Today producers are firm at the 6.40c. level. High-grade zinc is unchanged at 8@8¼c., delivered, in the East.

Tin Goes Above 50c.

Tin prices are again up to the levels of early September, with a fairly active market the last three days between 51 and 52c. per lb. Consumers continue to be rather indifferent about laying in forward supplies, three months' tin selling at about the same price as spot, although in some instances ¼c. premium has been obtained. Arrivals of tin to and including Oct. 20 were 2,915 long tons, according to the New York Metal Exchange. Stocks held by the Straits government are now reported to be about 3,000 long tons.

Foreign Exchanges Quiet

No important movements have been made in the foreign exchange market during the week, except that Dutch guilders touched a new high for the year. Sterling is somewhat higher, and francs and lire are slightly lower than a week ago. On Tuesday, Oct. 21, closing cable quotations on francs were 5.225c., and lire, 4.35c. Canadian dollars at par.

In some copies of the Oct. 18 issue the quotation for sterling exchange for Oct. 14 was incorrect. The correct quotation was 4.49½.

Silver Dull and Lower

With renewed selling, especially by China, the market has continued to decline, and local conditions as well as reports from abroad indicate small volume of business.

Mexican Dollars—Oct. 16th, 54⅞c.; 17th, 54¼c.; 18th, 54⅜c.; 20th, 54¼c.; 21st, 54¼c.; 22d, 54¼c.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—99 per cent grade, 28c. per lb.; 98 per cent, 27c. London, £125 per long ton.

Antimony—Per lb.:

Chinese and Japanese brands, 11⅝@11¾c. Demand fairly good in last week and supplies short.

Cookson's "C" grade, 14¼@14½c.

Bismuth—$1.85@$1.90 per lb. London, 7s. 6d.

Cadmium—55@60c. per lb. London, 2s. 2d.@2s. 6d.

Iridium—$260@$270 per oz.

Iridium alloyed with platinum, $280 @$286.

Nickel—29@30c. per lb. for 99 per cent virgin metal. Electrolytic, 33c.; London, £160 per long ton.

Palladium—$83 per oz. Crude, $60@$65.

Platinum:

Refined, $118 per oz.

Crude, $112@$113. Market inactive.

Quicksilver—$71 per 75-lb. flask. San Francisco wires $71.35; London, £11¾.

The prices of **Cobalt, Germanium Oxide, Magnesium, Molybdenum, Monel Metal, Osmiridium, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Tungsten,** and **Zirconium** are unchanged from the prices given in the Oct. 4 issue.

Metallic Ores

Chrome — $18.50@$24, depending upon grade and source. Nominal.

Manganese — 41@45c. per long ton unit, seaport, c.i.f. Nominal.

Molybdenum — 70@75c. per lb. of MoS_2 for 85 per cent concentrates. Nominal.

Tungsten Ore—Per unit, N. Y.:

High-grade wolframite, $8.75@$9.

High-grade scheelite, $9.

Ordinary grades, $8.25@$8.50.

Iron Ore, Galena and **Pyrite Radio Crystals, Tantalum,** and **Vanadium Ores** are unchanged from Oct. 4 quotations.

Zinc Higher, Lead Unchanged

Joplin, Mo., Oct. 18, 1924

Zinc Blende	Per Ton
High	$44.75
Premium, basis 60 per cent zinc	$43.50@$44.00
Prime Western 60 per cent zinc	$42.50@$43.00
Fines and slimes, 60 per cent zinc	$41.00@$39.00
Average settling price	$41.41

Lead Ore	
High	$110.35
Basis 80 per cent lead	$107.50@$110.00
Average settling price, all	$107.60

Shipments for the week: Blende, 17,899; lead, 2,466 tons. Value, all ores the week, $1,064,380.

Following the purchase last week of 20,130 tons, it was not expected generally that 12,930 tons would be contracted for this week, but the demand was such that all orders were not filled and sellers were asking further advances in price tonight. So much of the stock in reserve is held for a basis price above the present market level, and is in the hands of those who can hold it.

Buyers report lead prices at $107.50 basis, but so far as can be ascertained settlements on the larger quantity are being made on a basis of $110.

Platteville, Wis., Oct. 18, 1924

Zinc	Per Ton
Blende, basis 60 per cent zinc	$44.50

Lead	
Lead, basis 80 per cent lead	$109.00

Shipments for the week: Blende, 335 tons; lead, 80 tons. Shipments for the year: Blende, 24,140; lead, 880 tons. Shipments for the week to separating plants, 1,370 tons blende.

Non-Metallic Minerals

Magnesite — Calcined, $32@$35 per 2,000 lb. Demand falling off owing to importations.

Amblygonite, Asbestos, Barytes, Bauxite, Beryl, Borax, Celestite, Chalk, China Clay, Corundum, Diatomaceous Earth, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Gypsum, Ilmenite, Iron Oxide, Lepidolite, Limestone, Manjak, Mica, Monazite, Ocher, Ozocerite, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystals, Rutile, Silica, Spodumene, Sulphur, Talc, Tripoli and **Zircon** are unchanged from Oct. 4 prices.

Mineral Products

Arsenious Oxide (white arsenic)—7c. per lb. Practically no market.

Copper Sulphate—4.40@4.65c. per lb.

Sodium Nitrate—$2.40 per 100 lb.

Sodium Sulphate—$16@$17 per ton, New York.

Potassium Sulphate and **Zinc Oxide** are unchanged from Oct. 4 prices.

Ferro-Alloys

Ferromanganese—Domestic, German, and English, $100 per gross ton.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferro-uranium and Ferrovanadium are unchanged from the prices given in the Oct. 4 issue.

Metal Products

Rolled Copper—Sheets, 20⅜c. base; wire, 15⅛c.

Lead Sheets—Full, 10⅜c.; cut, 11c.

Nickel Silver—Grade A sheets, 18 per cent nickel, 26⅜c. per lb.

Yellow Metal—Sheets, 18⅛c. per lb.; rods, 15⅛c.

Zinc Sheets—10.25c. per lb.

Refractories

Bauxite Brick, Chrome Brick, Firebrick, Magnesite Brick, Magnesite Cement, Silica Brick, and **Zirkite** are unchanged from Oct. 4 prices.

Iron Trade Continues Dull

Pittsburgh, Oct. 21, 1924

About 35,000 freight cars have been bought since Sept. 1, and the movement seems to be nearly ended, with possibilities of resumption late in the year. In the same period about 500,000 tons of rails have been bought for 1925 delivery. Buying of steel generally is at about the same rate this month as in September, involving continuance of an operating rate in the steel industry between 60 and 65 per cent.

Prices throughout the United States are now well settled, since the elimination of the "Pittsburgh Plus" system, except that along the east coast no definite system has been set up for bars, shapes, and plates, prices being quite irregular.

In general, there is more active price competition between mills than two months ago, but only very occasionally is there any definitely marked decline in any line.

Fabricated steel bookings were much heavier in September than in September, 1923, bringing the nine-month average up to 67 per cent of fabricating shop capacity, against 65 per cent for the same period in 1923.

Pig Iron—There has been another week of extreme dullness, with prices unchanged: Bessemer, $20; basic, $19; foundry, $19.50@$20, f.o.b. Valley furnaces.

Connellsville Coke—The market has continued dull, with spot prices at $3@$3.10 for furnace, $4@$4.50 for foundry and $2.75@$3 for heating and smelter coke.

A Plea for the Proper Interpretation of Copper Statistics

TAKING EXCEPTION to the headlines that some of the daily newspapers have given to reports of slight increases in the stocks of refined copper, and to the way that these data are reported, in pounds instead of tons, Hamilton M. Brush, vice-president and sales manager of the American Smelting & Refining Co., has submitted to us a copy of a letter suggesting a fairer interpretation of the statistics. Readers of the *Mining Journal-Press* will find much of interest in Mr. Brush's letter, most of which we are publishing below. As recently announced, the statistical figures relating to the production, shipments, and stocks of copper are now being released to the press by the American Bureau of Metal Statistics. Mr. Brush says:

"In connection with the reporting of the statistics, and I refer particularly to copper, I have two concrete suggestions:

"1. The American Bureau is reporting its copper figures in tons of 2,000 lb. each and not in pounds. Generally the American Bureau figures are translated by the press from 'tons' into 'pounds.'

"I believe an effort should be made to report copper figures in net tons rather than in pounds, so that the mental picture of the reader will be the same in reading copper figures as it is when reading statistical figures covering steel, iron, tin, lead, zinc, and, in fact, almost every other metal in approximately the same class.

"The practice of quoting copper figures in pounds dates back to a period when the production and consumption of copper was of such comparatively minor importance that even the figure of the world's annual production of copper could be readily understandable when quoted in pounds. Now that the world's annual production and consumption of copper is up in the billions of pounds, and even the monthly production up in the hundreds of millions of pounds, most tabulations of copper figures look like a recent statement of the German Reichsbank. Much will be made of an increase or decrease of 10,000,000 pounds in the stock of copper, and such a figure, particularly to the uninitiated, sounds imposing. It is not nearly so imposing, however, to say that the stock of copper has increased or decreased by 5,000 tons, particularly when it is recognized that 5,000 tons of copper represents only approximately one day's production for the copper industry of the world.

"I believe, therefore, that the press will be doing a real service if it could back up the American Bureau in its endeavor to quote all copper statistics in 'tons' rather than in 'pounds.'

"There is no reason to believe that the consumption of copper in the future is not going to increase as it has increased in the past, and the standard of measurement should be commensurate with the size of the tonnage involved.

"2. The press, in interpreting copper statistics for several years past, has given undue prominence in headlines, and in articles, to the minor changes in the stock of copper from month to month and has explained many of the discouraging aspects of the market by referring to the large stock of refined copper held by the copper producers. This view is fundamentally wrong, and if carried to an extreme by the buyers of copper, or if eventually, by much repetition, it is believed in by the producers of copper, it will work great harm to the industry.

"If the price of copper has been unsatisfactory, it has been because of the willingness of the producers of copper to produce and sell all the copper which the world requires at such unsatisfactory levels. The stock has had nothing whatever to do with it, in my estimation. If we had a stock of 300,000 or 400,000 tons of copper the situation would be different, but the stock of copper carried by the copper producers of the United States during the last two years has, to my mind, been rather too small than too large.

"In the first place, without going into a mass of details to explain the reason for my statement, I can say most positively that the reported stock of copper, while theoretically all available for consumption, is not at any time available for consumption, because of the necessities of the twelve refineries which produce and carry the copper. Each one of these refineries is obliged to carry a stock of refined copper in the form of cathodes ahead of its furnaces to insure regular and orderly operation of its furnaces. It is impossible to name an exact figure, but I believe that even if copper were selling at 30c. per pound, the refineries would be showing a stock of from 40,000 to 50,000 tons of copper continuously on hand in their reports.

"Instead of having a surplus stock of refined copper, therefore, as reported, of from 125,000 to 150,000 tons, the copper producers really have an excess stock of only 75,000 to 100,000 tons. This is less than one month's production. The copper consumers of Europe, because of their financial difficulties, have been unable to carry any considerable stock of copper since the war. The copper consumers of the United States have never got into the habit of carrying any stock of copper at their works. There is no speculative copper of any moment carried in the United States outside of the refineries, and the only place in the world where a substantial stock of speculative copper exists is in London; there the stock is necessary as a back-log for the speculative dealings on the London Metal Exchange, and most of this copper is unavailable without refining for consumption in the usual channels. To have the copper-consuming industry of the world even temporarily run short of metal would be more disastrous to the industry, because of the temporary and unwarranted advance in the price, than an era of low prices would be. Of course, we all want high prices, but we don't want a few months of high prices followed by a severe reaction.

"Recognizing the situation set forth in the foregoing, therefore, I claim that the stock now being carried by the American copper producers is hardly sufficient to guard against some sudden combination of events which would increase the price temporarily because of a temporary shortage of supplies. Copper cannot be produced over night in commercial form, and any serious strike or railroad blockade affecting the larger properties might cause a very sudden call on the refined stock of copper here. If the copper producers of this country were not in the position to satisfy such a demand out of their stocks at a time when general business was active, we might witness a very unfortunate advance, followed by a subsequent decline which would be bad for everyone. I believe the copper producers of this country would not be shouldering their proper responsibility, or showing good business judgment, if they were unwilling to carry at least one month's production of refined copper in excess of current shipments as an insurance against unforeseen happenings. Why not, therefore, take a broad view of the situation and not make such a fuss about the monthly or quarterly increase or decrease of a few thousand tons in the stock of copper?

"Recently, several alarming headlines appeared showing that in three months, which happened to be the three summer months, and also three months of generally unsatisfactory business, copper stocks have increased by 50,000,000 lb. The fact is, such an increase amounts to only five working days of world copper production, and it occurred during ninety days of supposedly poor business. When expressed in tons, and particularly when expressed in days' production, and when properly interpreted, the figures just published are, to my mind, surprisingly favorable and do not warrant the headlines which have prejudiced the reader against them before he has seen the statistics."

German Potash Industry Improving

The following review of the German potash industry is taken from the London *Times* Trade and Engineering Supplement, of Oct. 4.

"Conditions in the potash industry have improved lately, both home and foreign trade of the Potash Syndicate being brisk. Home orders are mainly for kainite, fertilizer salts, and potassium chloride. The cheapening of coal and railway rates has not yet led to price reductions.

"Since the agreement with the Alsatian potash producers, shipments to the United States have increased, aided by the $6,000,000 credit given to the industry. Stocks have been considerably reduced, and some of the mines at which production had been suspended have been restarted. The mines which do not possess rich deposits of crude salts are not very favorably placed, as present prices do not leave them much profit; the majority will therefore remain closed until business has improved generally.

"Altogether, fifty-seven shafts, constituting about 25 per cent of the total have been closed in consequence of the

government order of October, 1921. At most of them production has been stopped on account of poor deposits or for other technical reasons which make working unprofitable. Some, however, are being kept in a condition which will allow them to be restarted after the stipulated suspension of production. Of the shafts under construction at the time the order was passed, twenty-three have been finished, and as regards ten others it has not been decided whether they are to be finished or not. The productive capacity of the mines in operation is still above the average output since 1919 and the sinking of new shafts will not be necessary for years to come.

"Whether more mines will be closed cannot be decided at present, as the future prospects are still obscure. The sinking of new shafts is prohibited by law, but even if this were not the case it would probably be impossible to obtain the necessary capital for such an undertaking. Geologists assert that there are still huge untapped deposits in this country."

Gains by Other Companies Offset Passing of October Bethlehem Steel Dividend

The following dividends were paid by mining and metallurgical companies in October:

Companies in the United States	Situation	Per Share	Total
Cardiff Mining & Milling, s, l	Utah	$0.10 I	$50,000
Cresson Consolidated Gold	Colo.	0.10 Q	122,000
Eagle-Picher Lead pfd	Various	1.50 Q	15,000
Homestake Mining, g	S. D.	0.50 M	125,580
Inland Steel pfd	Minn.	1.75 Q	175,000
Kennecott Copper	Alaska	0.75 Q	2,090,341
New Jersey Zinc	Various	2.00 X	909,328
Park City, s,l,z	Utah	0.15 Q	131,400
Phelps Dodge, c	Various	1.00 Q	500,000
Republic Iron & Steel pfd	Various	1.75 Q	437,500
Silver King Coalition, s,l	Utah	0.15 Q	182,415
Sloss-Sheffield Steel & Iron pfd	Ala.	1.75 Q	117,250
Tamarack & Custer, s,l	Idaho	0.02 I	100,000
Tonopah Extension, s,g	Nev.	0.05 Q	69,636
Tonopah Mining, s, g	Nev.	0.075SA	75,000
U. S. Smelting, Refining & Mining, s, l	Various	0.875Q	425,556
Companies in other countries			
Ahumada Lead	Chihuahua	0.15 Q	178,053
Asbestos Corporation pfd	Quebec	1.50 Q	60,000
Dome Mines, g	Ont.	0.50 Q	238,333
Erupcion, l	Chihuahua	0.15 Q	187,500
Hollinger Consolidated Gold	Ont.	0.05 4 wks.	246,000
Kerr Lake, s	Ont.	0.125SA	75,000
N. Y. & Honduras Rosario, g, s	Honduras	0.50 QZ	100,000
Nipissing Mines, s	Ont.	0.30 QY	360,000
Premier Gold, s, g	B. C.	0.08 Q	400,000
Silversmith, s, l, z	B. C.	0.01 Q	25,000
Wright-Hargreaves, g	Ont.	0.025Q	68,750
			$7,464,642

Q, quarterly; SA, semi-annually; M, monthly; I, irregularly; X, extra dividend; Z, 25c. extra; Y, 15c. extra; g, gold; s, silver; c, copper; l, lead; z, zinc.

The total of dividends for October showed a slight decrease, being about $500,000 less than those paid three months ago. This was largely attributable to the passing of the regular quarterly dividend on Bethlehem Steel common, which had amounted to $845,106. The regular dividends were, however, paid on the preferred. United Eastern also finally disappears from the dividend list. On the other hand, New Jersey Zinc decided that it was sufficiently prosperous to disburse an extra $900,000 to its stockholders; and high prices for lead and silver led Tamarack & Custer to make the first payment since October, 1923, and Nipissing and N. Y. & Honduras Rosario to double the usual dividend expected at this time. Cardiff paid its first dividend since last December after a profitable season.

Company Report

Trethewey Silver-Cobalt Mine, Ltd.

The Trethewey Silver-Cobalt Mine, Ltd., has issued a balance sheet as of June 30, 1924, as follows:

Assets

Castle-Trethewey Mines, Ltd., 400,000 shares at par		$400,000.00
Sundry assets		1,004.00
Deficit		1,199,814.11
		$1,600,818.11

Liabilities

Capital stock		
Authorized 2,000,000 shares at $1 par	$2,000,000.00	
Issued and outstanding		$1,599,998.00
Account payable		820.11
		$1,600,818.11

Imports and Exports of Ores and Metals in August, 1923 and 1924

Imports

In Pounds, Unless Otherwise Stated

	August, 1923	August, 1924
Antimony		
Ores	50,260	54,429
Metals, matte, and regulus	2,735,484	164,444
Copper		
Ore	15,494,437	7,311,201
Concentrates	4,130,007	5,018,145
Regulus, coarse, metal, and cement copper	2,192,826	24,845
Total	21,817,270	12,354,191
Imported from		
Spain	252,448	974,599
Canada	6,157,868	2,073,966
Mexico	1,850,470	2,128,722
Cuba	3,264,131	2,685,000
Chile	9,647,102	3,687,191
Colombia		93
Peru	116,814	115,760
Other countries	528,437	688,860
Unrefined black, blister converter copper in pigs	55,041,544	29,215,759
Imported from:		
Spain		1,486,304
United Kingdom		13,182
Canada	6,666,013	4,302,269
Mexico	8,896,317	3,843,264
Chile	20,899,266	4,097,634
Peru	8,324,881	6,936,387
Portuguese Africa	9,712,092	8,536,719
Other countries	542,975	
Refined copper	7,918,580	16,227,761
Old and clippings for remanufacture	449,609	309,401
Composition metal, copper chief value	5	100,161
Copper manufactures	5,830	9,792
Brass		
Old and clippings for remanufacture	1,793,075	425,931
Manufactures of brass	57,360	74,422
Lead		
Ore and matte	3,153,598	14,325,950
Bullion or base bullion	11,501,423	8,808,908
Pigs, bars, other forms, and old	792	296,087
Manufactures of, except type metal	19,314	15,897
Manganese ore, long tons	23,026	16,160
Pyrites, long tons	3,542	28,210
Tin		
Tin ore, tons		8
Tin in blocks, bars, and pigs	12,708,995	7,336,145
Imported from:		
United Kingdom	2,051,224	1,568,464
British Straights Settlements	7,782,617	5,433,477
Dutch East Indies	1,274,929	76,311
Hongkong	1,425,107	168,090
Australia	33,600	11,200
Other countries	141,518	248,603
Zinc ore { Free	53,838	67,607
Dutiable		6,733,347
Zinc in blocks, pigs, and other forms (dutiable)	4,958	
Zinc dust (dutiable)	34,371	7,114

Exports of Copper, Lead, and Zinc

In Pounds

	August, 1923	August, 1924
Copper		
Ores, concentrates, matte and regulus	4,151	
Copper and manufactures of	69,952,768	84,196,076
Refined, in ingots, bars and other forms	63,925,048	72,873,283
Exported to		
Belgium	7,232,705	6,557,594
France	16,739,321	13,719,750
Germany	9,580,045	8,992,069
Italy	4,909,005	7,995,853
Netherlands	268,929	3,588,295
Spain	134,480	585,582
Sweden	2,243,181	1,225,834
United Kingdom	14,959,937	18,506,411
Canada	2,501,797	2,028,662
China	347,200	5,185,600
Japan	4,311,337	3,303,585
Other countries	697,111	1,184,048
Old and scrap	151,617	238,594
Composition metal, copper chief value	5,708	5,007
Pipes and tubes	496,952	306,989
Plates and sheets	199,930	442,242
Rods	3,301,453	6,931,748
Wire	797,761	983,575
Insulated wire and cable	896,974	2,244,507
Lead		
Pigs, bars and other forms		
From domestic ore	626,690	1,262,255
From foreign ore	14,369,484	14,757,982
Exported to:		
France	3,808,990	1,342,750
Germany	3,136,985	2,978,925
Netherlands	1,008,159	951,881
United Kingdom	5,376,548	7,270,845
Other Europe	784,113	631,813
Argentina	133,241	1,075,715
Brazil	423,324	873,733
Other countries	324,814	894,575
Zinc		
Ore, concentrates, and dross	5,424,739	3,724,549
Spelter in slabs, blocks and other forms	2,132,206	14,290,311
Exported to:		
Belgium		478,131
France	896,034	1,263,793
Italy	447,937	336,118
Germany	224,028	1,624,394
United Kingdom	280,039	10,341,311
Canada	50,013	11,219
Other countries	234,155	235,345
In sheets, strips, and other forms	539,755	488,385
Zinc dust	524,837	444,613
Other zinc manufactures	185,202	48,614

Current Prices of Mine Materials and Supplies

RISE AND FALL OF THE MARKET

Firmness is especially noticeable in cast-iron pipe, pine and fir lumber and linseed oil. Wrought steel pipe is in better demand in all sections of the country except the Far West. Railroads are taking the bulk of the steel tonnage now being sold. Some weakness in steel shapes developed during past week. Advances are still in excess of declines, especially in the construction materials market.

SHEETS—Quotations are per 100 lb. in various cities from warehouse also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	St. Louis	Chicago	San Francisco	New York
No. 10	$2.60@2.70	$3.90	$3.80	$3.95	$3.89
Black No. 28	3.40@3.50	4.65	4.50	5.00	4.60
Galvanized No. 28	4.50@4.60	5.65	5.50	5.90	6.60

STEEL RAILS—The following quotations are per ton f.o.b. Pittsburgh and Chicago for carload or larger lots:

	Pittsburgh Current	Pittsburgh One Year Ago	Birmingham	Chicago
Standard bessemer rails	$43.00	$43@45	$43.00	$46.00
Standard openhearth rails	43.00	43@45	43.00	46.00

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh Current	Pittsburgh One Year Ago	Chicago	St. Louis	San Francisco	Birmingham
Standard spikes, ⅜-in. and larger	$1.80	$3.15	$3.65	$3.75	$4.35	$3.72
Track bolts	3.75@4.00	4.00	4.65	4.65	5.85	4.57
Standard section angle bars	2.75	2.75	3.40	3.40	4.00	3.20

STRUCTURAL MATERIAL—Following are base prices f.o.b. mill, Pittsburgh and Birmingham together with quotations per 100 lb. from warehouses at places named:

	Pittsburgh, Mill	Birmingham Mill	New York	Dallas	St. Louis	Chicago	San Francisco
Beams, 3 to 15 in.	$1.90@2.00	$2.75	$3.34	$4.15	$3.25	$3.10	$3.00
Channel, 3 to 15 in.	1.90@2.00	2.75	3.34	4.15	3.25	3.10	3.00
Angles, 3 to 6 in., ¼ in. thick	1.90@2.00	2.75	3.34	4.15	3.25	3.10	3.00
Tees, 3 in. and larger	1.90@2.00	2.75	3.34	4.15	3.30	3.10	3.05
Plates	1.60@1.90	2.50	3.34	4.15	3.25	3.10	3.00

WIRE ROPE—Discounts from list price, f.o.b. New York and east of Missouri River, on regular grades of bright and galvanized are as follows:

Cast steel round strand rope	20%
Galvanized steel rigging and guy rope	7½%
Round strand iron and iron tiller	5%
Plow steel round strand rope	35%
Special steel round strand rope	30%
Galvanized iron rigging and guy rope	+12½%

	New York	Cleveland	Chicago
Drill Rod (from list)	60%	55%	50%

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

	Inches	Steel Black	Steel Galv.	Inches	Iron Black	Iron Galv.
BUTT WELD—	1 to 3	62	50½	1 to 1½	30	13
LAP WELD—	2½ to 6	59	47½	3 to 6	28	13

STEEL PIPE—From warehouses at the places named the following discounts hold for steel pipe:

	Black New York	Black Chicago	Black St. Louis
2½ to 6 in. lap welded	44%	53%	46%

CBST-IRON PIPE—The following are prices per net ton for carload lots:

	New York Current	New York One Year Ago	Birmingham	Chicago	St. Louis	San Francisco
6 in. and over	$56.60@57.60	$63.60	$50.00	$56.20@57.20	$50.60	$56.00

Nuts—	New York	Cleveland	Chicago
Hot pressed, sq., per 100 lb. Off list	$1.50	$4.00	$4.00
Cold punched, sq., per 100 lb. Off list	1.50	4.00	4.00

HOLLOW TILE—Price per block in carload lots to contractor for hollow building tile.

	New York Current on Trucks	New York One Year Ago	Chicago	Philadelphia	St. Louis	San Francisco	Perth Amboy, N. J., Factory
4x12x12	$0.1162	$0.1179	$0.089	$0.125	$0.077	$0.108	.....
6x12x12	.1743	.1769	.114	.....	.103	.156	$0.2786*
8x12x12	.2179	.2211	.163	.215	.14	.244	.3448†

* 10x12x12; † 12x12x12.

MACHINE BOLTS—	New York	Cleveland	Chicago
All sizes up to 1x30-in.	50%	60%	60%

LUMBER—Prices of rough Douglas Fir No. 1 common, in carload lots to dealers at yards in San Francisco. To contractors, $2 per M. ft. additional.

	6-8 and 12 Ft.	10-16-18 and 20 Ft.	22 and 24 Ft.	25 to 32 Ft.
3x3 and 4	$28.00	$29.00	$30.00	$35.00
3x6 and 8	28.00	29.00	30.00	35.00
4x4-6 and 8	28.00	29.00	30.00	35.00

Wholesale prices to dealers of long leaf yellow pine. To contractors in New York City, delivered from lighters or cars to job, $5 additional.

	New York 20 Ft. and Under	New York 22-24 Ft.	Chicago 20 Ft. and Under	Chicago 22-24 Ft.
3x4 to 8x8	$40.00	$41.00	$52.00	$56.00
3x10 to 10x10	45.00	46.00	53.00	56.00
3x12 to 12x12	51.00	52.00	55.00	58.00

Other Cities	8 x 8-In. x 20 Ft. and Under Pine	Fir*	Hemlock	Spruce	12 x 12-In. 20 Ft. and Under Pine	Fir*
Boston	$56.00	$53.00†	$49.00	$49.00	$68.00	$66.00†
Cincinnati	40.00	74.00	74.00	88.00	44.00	78.00
Denver	.....	35.75	35.75	35.75	.....	34.75
Minneapolis	40.00	37.75	39.00	.....	43.10	37.75
Kansas City	38.25	.....	.....	.....	48.25	.....
Birmingham	20@30	.....	.....	.....	25@33	.....

* Douglas fir. † Prime.

NAILS—The following quotations are per keg from warehouse:

	Pittsburgh, Mill	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	$2.80	$3.80	$4.10	$4.55	$3.24	$4.95
Cut	2.90	4.45	5.25	5.00	3.49	5.00

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots *without bags*. Cash discount not deducted.

	Current	One Month Ago	One Year Ago
New York, del. by truck	$2.50@2.60	$2.50@2.60	$2.70@2.80
Chicago, f.o.b.	2.20	2.20	2.20
Cleveland, f.o.b.	2.39	2.39	2.46

LIME—Warehouse prices:

	Hydrated, per Ton Finishing	Hydrated, per Ton Common	Lump, per Barrel Finishing	280-lb. net Common
New York	$18.20	$13.10	$3.75	$2.50@$3.00
San Francisco	22.60	....	....	(180-lb. net) 2.15

LINSEED OIL—These prices are per gallon:

	New York Current	New York One Year Ago	Chicago Current	Chicago One Year Ago
Raw in barrel (5 bbl. lots)	$1.03	$0.95	$1.05	$1.14

WHITE AND RED LEAD—In 100-lb. kegs, base price in cents per pound:

	Dry Current	Dry 1 Yr. Ago	In Oil Current	In Oil 1 Yr. Ago
Red	14.75	14.00	16.25	15.50
White	14.75	14.00	14.75	14.00

HOSE—Quotations at New York warehouses:

Fire Protection — 50-Ft. Lengths

Underwriters' 2½-in. coupled, single jacket ..... 56c per ft.

Air—Best Grade

¾-in., per ft.	3 ply	$0.36	4 ply	$0.44½

Steam—Discounts from List

First grade ..... 30–5% Second grade ..... 40–5% Third grade ... 50%

RUBBER BELTING—The following discounts from list apply to rubber transmission belting:

Best grade ..... 50% Second grade 50–10%

LEATHER BELTING—List price, 24c. per lin.ft. per inch of width for single ply at New York warehouses:

Grade	Discount from list
Medium	40–2½%
Heavy	30–5%

RAWHIDE LACING—For cut, best grade, 45–5%, 2nd grade, 55%. For laces in sides, best, 41c. per sq.ft.; 2nd, 37c. Semi-tanned: cut, 45–5%; sides, 41c. per sq.ft.

PACKING—Prices per pound:

Rubber and duck for low-pressure steam, ⅛ in.	$0.90
Rubber sheet	.45
Rubber sheet, wire insertion	.70

MANILA ROPE—Per lb., ¼-in. and larger, 1,200-ft. coils.

Atlanta	$0.20	New Orleans	$0.17½
New York	.18½	Seattle	.17
Chicago	.18	San Francisco	.17

EXPLOSIVES—Prices per pound of dynamite in small lots:

	Gelatin 40%	Gelatin 60%
New York	$0.27	$0.295
Minneapolis	.1917	.2123
Denver	.2025	.2275
Seattle	.165	.19
Cincinnati	.22	.245
New Orleans	.235	.29
San Francisco	.1625	.1925

FLOTATION OILS—All prices are per gal. in carload lots; 50-gal. bbls., gross weight 500 lbs.

Pine oil, steam dist., f.o.b. New York	$0.60
Pine tar oil, f.o.b. New York	.30

CHEMICALS—

Zinc dust, 550 lb. casks, f.o.b. Palmerton, Pa., per lb.	$0.08½
Litharge, f.o.b. New York, kegs, per 100 lb.	14.85
Sodium cyanide, 220 lb. single case lots, f.o.b. New York, per lb.	.19@.22

Mining Stocks

Week Ended October 18, 1924

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Alaska-Br. Col.	N. Y. Curb			*37		
Anaconda	New York	36	34⅛	35⅞	De.15, Ja.21, Q	0.75
Arcadian Consol.	Boston	1¼	1	1		
Ariz. Com'l	Boston	9⅛	9 3/16	9⅛	Jy.19, Jy.31	0.50
Calaveras	N. Y. Curb			2		
Calumet & Arizona	Boston	52	47	47	Se. 5, Se. 22 Q	0.50
Cal. & Hecla (New)	Boston	15	14½	15	My. 31, Jn. 16	0.50
Canario Copper	N. Y. Curb	3⅞	3½	3⅞		
Cerro de Pasco	New York	46½	45¼	46	Oc. 23, No. 1	1.00
Chile Copper	New York	31⅞	31	31⅝	Se.3, Se.29, Q	0.62½
Chino	New York	20	20	20	Sept., 1920	0.37½
Con. Coppermines	N. Y. Curb	3⅞	3¼	3¼		
Copper Range	Boston	23¼	22	23½	May, 1923	1.00
Crystal Copper	Boston Curb	*62	*40	*40		
Davis-Daly	Boston			*41	Mar., 1920	0.25
East Butte	Boston	3⅞	3½	3¾	Dec., 1919	0.50
First National	Boston Curb	*37	*36	*36	Feb., 1919	0.15
Franklin	Boston			*55		
Gadsden Copper	Boston Curb			*65		
Granby Consol.	New York	18	16¾	17⅞	May, 1919	1.25
Greene-Cananea	New York	14	14	14	Nov., 1920	0.50
Hancock	Boston			1		
Howe Sound	N. Y. Curb	2⅜	2¼	2⅜	Ap.1,Ap.15, Q	0.05
Inspiration Consl.	New York	25	24¼	24⅜	De.20, Ja.7, Q	0.50
Iron Cap	Boston Curb	2½	2½	2½	May, 1923	0.15
Isle Royale	Boston	15	14½	14⅝	Se. 1, Se. 15	0.50
Jerome Verde Dev.	N. Y. Curb	1	*95	1		
Jib Consol.	N. Y. Curb	*51	*33	*41		
Kennecott	New York	46	44⅛	46	Se.5, Oc.1, Q	0.75
Keweenaw	Boston			*65		
Lake Copper	Boston			1⅞		
Magma Copper	New York	34	32½	34	Jan., 1919	0.50
Mason Valley	N. Y. Curb	1⅞	1⅞	1⅞		
Mass Consolidated	Boston	1	1	1	Nov., 1917	1.00
Miami Copper	New York	21⅜	20½	21	No.1 No.15 Q	0.50
Mohawk	Boston	31⅛	30⅛	31⅛	Se. 22, Oc. 13	1.00
Mother Lode Con.	New York	7⅞	7⅞	7⅞	Jn. 13, Jn. 30	0.37½
Nevada Consol.	New York	13⅞	13⅜	13⅞	Sept., 1920	0.25
New Cornelia	Boston	20	19¾	20	Au. 8, Au. 25	0.25
New Dominion	N. Y. Curb			2½		
North Butte	Boston	3⅛	2⅞	3⅛	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	1 1/16	*99	*99		
Old Dominion	Boston	20⅛	19⅞	20⅛	Dec., 1918	1.00
Phelps Dodge	Open Mar.	†115	†110		Se.20, Oc.1 Q	1.00
Quincy	Boston	19⅛	19	19⅛	Mar., 1920	1.00
Ray Consolidated	New York	12⅛	11⅝	12⅛	Dec., 1920	0.25
Ray Hercules	N. Y. Curb			*15		
St. Mary's Min. Ld.	Boston	34	32¼	34	Ap.22, My.20	3.00
Seneca Copper	New York	1½	1	1⅛		
Shannon	Boston			*75	Nov., 1917	0.25
Shattuck Arizona	New York	6	5½	6	Jan., 1920	0.25
Superior & Boston	Boston	1⅛	1⅛	1⅛		
Tenn. C. & C. ctfs	New York	7½	7¼	7½	De.31, Ja.15,Q	0.25
United Verde Ex.	N. Y. Curb	26	25½	25½	Oc. 3, No. 1	0.50
Utah Copper	New York	80	77⅛	80	Se.15, Se.30,Q	1.00
Utah Metal & T.	Boston	*28	*25	*25	Dec., 1917	0.30
Victoria	Boston	*50	*50	*50		
Walker Mining	N. Y. Curb			3		
Winona	Boston	*20	*20	*20		
NICKEL-COPPER						
Internat. Nickel	New York	18⅛	17¼	18⅛	Jy.17, Au.1, Q	1.50
Internat. Nickel pfd.	New York	90	89¼	90	Oc.16, No.1, Q	1.50
LEAD						
Carnegie Lead & Zinc	Pittsburgh	3½	3½	3⅜		
National Lead	New York	150½	147½	150½	Se.12, Se.30, Q	2.00
National Lead pfd.	New York	116	116	116	Au.22, Se.15, Q	1.75
St. Joseph Lead	New York	33⅞	32	33⅜	De. 9, De. 20	0.50
ZINC						
Am. Z. L. & S.	New York	7½	7	7⅛	May, 1920	1.00
Am. Z. L. & S. pfd.	New York	26½	26¼	26½	Nov., 1920	1.50
Butte C. & Z.	New York	5⅛	5	5	Mar., 1923	0.50
Butte & Superior	New York	16⅛	15½	16	Je.15, Je.30, Q	0.50
Callahan Zn-Ld	New York	3⅛	3	3⅛	Dec., 1920	0.50
New Jersey Zn.	N. Y. Curb	165⅜	164	164	Oc.,No.,'24 QX	4.00
United Zinc	N. Y. Curb			*25		
Yellow Pine	Los Angeles	67½	67½	67½	June, 1924	0.04
SILVER						
Alvarado	N. Y. Curb	1⅛	1⅛	1⅛		
Beaver Consol.	Toronto	*17	*16½	*16½	May, 1920	0.03
Castle-Trethewey	Toronto	*74	*70½	*73½		
Coniagas	Toronto	2.10	2.10	2.10	Ap.20, My.1	0.02½
Crown Reserve	Toronto	*50½	*47	*49	Jan., 1917	0.05
Keeley	Toronto	2.33	2.28	2.32	Sept. 15, SA	0.12
Kerr Lake	N. Y. Curb	1⅞	1⅞	1⅞	Oc. 1, Oc. 15,	0.12½
La Rose	Toronto	*8	*8	*8	Apr., 1922	0.10½
Lorrain Trout Lake	Toronto	1.45	1.43	1.43		
McKinley-Dar.-Sav.	Toronto	*13⅛	*12	*13	Oct., 1920	0.03
Mining Corp. Can.	Toronto	2.67	2.65	2.65	Sept., 1919	0.12½
Nipissing	N. Y. Curb	6¼	6	6⅛	Oc.1,Oc.20,QX	0.30
Ontario Silver	New York	8⅜	7⅛	7	Jan., 1919	0.50
Temiskaming	Toronto	*23	*18	*20	Jan., 1920	0.40
GOLD						
Alaska Gold	New York	*20	*20	*20		
Alaska Juneau	New York	1¼	1⅛	1⅛		
Argonaut	Toronto	*32	*30	*31		

Stock	Exch.	High	Low	Last		Last Div.
Carson Hill	Boston	1¼	1¼	1¼		
Cresson Consol. G.	N. Y. Curb	3½	3½	3½	Se.30, Oc.6 Q	0.10
Dome Mines	New York	14⅝	14½	14½	Oc.3, Oc.20, Q	0.50
Golden Cycle	Colo. Springs	1.30	1.30	1.30	My.31, Jn.10 Q	0.03
Hollinger Consol.	Toronto	14.55	14.45	14.45	Oc.16, No.3, M	0.05
Homestake Mining	New York	47	45	47	Oc.20,Oc.25,M	0.50
Kirkland Lake	Toronto	*19	*18½	*18½		
Lake Shore	Toronto	3.95	3.90	3.90	Se.1, Se.15, Q	0.05
McIntyre-Porcupine	New York	15½	15¼	15½	No. 1, De. 1	0.25
Newray	Toronto	*24	*24	*24		
Portland	Colo. Springs	45	45	45	Oct., 1920	0.01
Teck-Hughes	Toronto	1.14	1.12	1.13		
Tom Reed	Los Angeles	25¾	18	25½	Dec., 1919	0.02
Tough-Oakes	Toronto	*54	*51½	*52		
United Eastern	N. Y. Curb	*37	*37	*37	Jy.18, Jy.31, Q	0.05
Vipond Cons.	Toronto	1.26	1.23	1.24		
Wright-Hargreaves	Toronto	3.70	3.62	3.65	Se.15,Oc.1, Q	0.02½
GOLD AND SILVER						
Black Oak	N. Y. Curb			*89		
Con. Cortez	N. Y. Curb	*15	*12	*12		
Con. Virginia	San Francisco	7	4½	6½		
Continental Mines	N. Y. Curb			2¼		
Dolores Esperanza	N. Y. Curb			*32	Jy.1, Jy.10 Q	0.05
Premier Gold	N. Y. Curb	2⅜	2 3/16	2 3/16	Se. 25, Oc. 30	0.08
Tonopah Belmont	N. Y. Curb			*59	Apr., 1923	0.05
Tonopah Divide	N. Y. Curb			*24	Se. 22, Oc. 10	0.10
Tonopah Extension	N. Y. Curb	3⅞	3⅜	3⅜	Se. 10, Oc. 1	0.05
Tonopah Mining	N. Y. Curb	1⅝	1¼	1⅝	Se. 30, Oc. 21	0.07½
Unity Gold	N. Y. Curb	1	1	1		
West End Consol.	N. Y. Curb	*51	*51	*51	Mar., 1923	0.05
Yukon Gold	N. Y. Curb			*50	June, 1918	0.02
SILVER-LEAD						
Ahumada	Boston Curb	6½	6	6½	Se.16, Oc.2, X	0.15
Bingham Mines	Boston	15¾	15¼	15½	Sept., 1919	0.25
Cardiff M. & M.	Salt Lake			*75	Dec., 1920	0.15
Chief Consol.	Boston Curb	2⅞	2¾	2⅞	Ap.19, My.1,Q	0.10
Columbus Rexall	Salt Lake	30	27	28	Aug., 1920	0.03
Consol. M. & S.	Montreal	44	43½	43½	Jn.30, Jy.15	0.75
Daly Mining	Salt Lake			2.00	July, 1920	0.10
Eruncion	Boston Curb			2¼	Se. 15, Oc. 2, X	0.15
Federal M. & S.	New York			12½	Jan., 1909	1.50
Federal M. & S. pfd.	New York	49½	49	49½	Au.25, Se.15,Q	1.75
Florence Silver	Spokane	6	5½	5½	Apr., 1919, QX	0.01
Hecla Mining	N. Y. Curb	9¾	9⅝	9⅝	Sept. 15, 1924	0.25
Iron Blossom Con.	N. Y. Curb	*25	*25	*25	Oct., 1923	0.02
Marsh Mines	N. Y. Curb			*5	June, 1921	0.02½
Park City	Salt Lake	4.00	4.00	4.00	Se. 15, Oc. 1	0.15
Park Utah	N. Y. Curb			3½	Mc. 15, Ap. 1	0.15
Prince Consol.	Salt Lake			*8½	Nov., 1917	0.02
Silver King	N. Y. Curb			*50	Se. 20, Oc. 1	0.15
Silversmith	Spokane	*28	*27	*27½	Oc. 1, Oc. 10	0.01
Tamarack-Custer	Spokane	1.41	1.38	1.40	Se. 22, Se. 29	0.25
Tintic Standard	Salt Lake	7.10	6.95	7.10	Se.1, '24, X	0.25
Utah-Apex	Boston	2¼	2⅛	2¼	Se.5, Se.15, Q	0.25
IRON						
Bethlehem Steel	New York	44	42⅞	43⅝	Jn.1, Jy.1, Q	1.25
Char. Iron	Detroit			*30		
Char. Iron pfd.	Detroit	*70	*70	*70		
Colorado Fuel & Iron	New York	42⅜	35	41½	Au.11, Au.25,Q	2.00
Col. Fuel & Iron pfd.	New York			108½	Feb., 1923	2.00
Gt. North'n Iron Ore	New York	29⅛	28½	28⅞	De.10, De.27	2.00
Inland Ste. I.	N. Y. Curb			4	Au.5, Se.1 Q	0.62½
Mesabi Iron	N. Y. Curb			2⅞		
Replogle Steel	New York	11⅞	10½	11⅞		
Republic I. & S.	New York	44⅞	42⅝	43⅞	May, 1921	1.50
Republic I. & S. pfd.	New York	85	84	84½	Se.15, Oc.1, Q	1.75
Sloss-Sheffield S. & I.	New York	70	66¼	70	Se.11, Se.20, Q	1.50
Sloss-Shef. S.&I. pfd.	New York			89	Se.20, Oc.1, Q	1.75
U. S. Steel	New York	107¼	104⅞	107¼	Se.1, Se.29 QX	1.75
U. S. Steel pfd.	New York	122⅝	121⅞	122⅞	Au.5, Au.30, Q	1.75
Virginia I. C. & C.	New York			37⅝	De.15, Ja.2	1.50
Virginia I.C.&C.pfd.	New York	76	76	76	Jn. 17, Jy. 1	2.50
VANADIUM						
Vanadium Corp.	New York	22½	22	22½	Jan., 1921	1.00
ARSENIC						
Western Utah Copper	N. Y. Curb	*16	*16	*16		
ASBESTOS						
Asbestos Corp.	Montreal	26	26	26	Se.29, Oc.15 Q	1.00
Asbestos Corp. pfd.	Montreal	62⅛	62¾	62¾	Oc.1, Oc.15, Q	1.50
SULPHUR						
Freeport Texas	New York	8¼	7⅞	8⅛	Nov., 1919	1.00
Texas Gulf	New York	78	75⅝	77⅛	Se.2,Se.15, QX	1.75
PLATINUM						
So. Am. Gold & P.	N. Y. Curb	5¼	4¼	5¼		
MINING, SMELTING AND REFINING						
Amer. Metal	New York	46½	45	46½	Au.18, Se.2 Q	0.75
Amer. Metal pfd.	New York			113	Au.20, Se.2, Q	1.75
Amer. Sm. & Ref.	New York	75⅝	73¼	75½	Oc.17, No.1, Q	1.25
Amer.Sm.&Ref.pfd.	New York	103⅞	103	103⅞	No.17, De.1 Q	1.75
U. S. Sm. R. & M.	New York	34¼	31⅞	32⅝	Jan., 1921	0.50
U.S. Sm. R.&M.pfd.	New York	45⅞	43¼	45⅞	Oc.9, Oc.15 Q	0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Colorado Springs, Colorado Springs Stock Exchange.